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Issued June 18, 1910.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—BULLETIN NO. 67.

MILTON WHITNEY, Chief.

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# FERTILIZERS ON SOILS USED FOR OATS, HAY, AND MISCELLANEOUS CROPS.

BY

MILTON WHITNEY

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## BUREAU OF SOILS.

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W J MCGEE, in charge of Soil Water Investigations.

# LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Soils,
*Washington, D. C., November 15, 1909.*

Sir: In order to establish certain fundamental principles regarding the effect and efficiency of fertilizers on soils for oats, hay, and certain other miscellaneous crops, I have had compiled all the available results of plat tests which have been carried out with fertilizers on such soils by the experiment stations.

It is believed that this matter will be of considerable interest to the farmers of the country, and I therefore have the honor to recommend that this material be published as Bulletin No. 67 of the Bureau of Soils.

Very respectfully,

Milton Whitney,
*Chief of Bureau.*

Hon. James Wilson,
*Secretary of Agriculture.*

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# FERTILIZERS ON SOILS FOR OATS, HAY, AND MISCELLANEOUS CROPS.

## FERTILIZERS ON SOILS USED FOR OATS.

### INTRODUCTION.

The experiment stations have recorded in their reports and bulletins the results of 1,483 tests of substances applied to oat soils, that is, soils upon which oats are to be grown.

Each test represents some single substance used alone or some combination of substances, and every result has been taken where the yield of a check or unfertilized plat has been recorded, and where the amount of each substance per acre could be determined, and the yield or increased yield per acre of the crop could be found. The results have been accepted whether the plats were located on the Station farm or the experiments were carried out by cooperating farmers. No experiments from any source not accepted and adopted by the stations and recorded in their official publications have been considered in this bulletin.

### NUMBER OF EXPERIMENTS.

The number of individual fertilizer tests on oat soils so far as this can be determined from the reports of stations is given by years in the following table:

*Number of individual tests on oat soils arranged according to years.*

| Year. | Number. | Year. | Number. | Year. | Number. | Year. | Number. |
|---|---|---|---|---|---|---|---|
| 1876 | 4 | 1886 | 142 | 1894 | 76 | 1903 | 7 |
| 1877 | 1 | 1887 | 81 | 1895 | 68 | 1904 | 5 |
| 1879 | 9 | 1888 | 46 | 1896 | 116 | 1905 | 19 |
| 1880 | 8 | 1889 | 109 | 1897 | 73 | 1906 | 4 |
| 1882 | 104 | 1890 | 67 | 1899 | 34 | 1907 | 3 |
| 1883 | 8 | 1891 | 89 | 1900 | 45 | | |
| 1884 | 61 | 1892 | 70 | 1901 | 16 | Total | 1,483 |
| 1885 | 11 | 1893 | 97 | 1902 | 110 | | |

The following table shows the number of tests recorded in the publications of each State:

*Fertilizer plat tests on oat soils, arranged according to the number of individual tests made in each State.*

| State. | Number. | State. | Number. | State. | Number. |
|---|---|---|---|---|---|
| Pennsylvania | 710 | California | 22 | Arkansas | 7 |
| Ohio | 279 | Utah | 21 | Delaware | 7 |
| New Jersey | 71 | Alabama | 20 | Kentucky | 7 |
| Louisiana | 59 | New Hampshire | 20 | Wisconsin | 5 |
| Connecticut | 58 | Georgia | 18 | Minnesota | 4 |
| Maine | 34 | Massachusetts | 16 | Colorado | 2 |
| Indiana | 32 | Kansas | 13 | Maryland | 1 |
| New York | 31 | Rhode Island | 13 | | |
| South Carolina | 24 | Tennessee | 9 | Total | 1,483 |

## YIELDS ON CHECK PLATS.

The investigations have been made under a wide range of soil conditions, of climatic conditions, or both, as measured by the yield of the unfertilized or check plats which have ranged from less than 10 to more than 80 bushels per acre. The following table gives the individual and average yields of oats on the check plats when more than one such plat has been used and separately rendered.

Unfortunately, owing to the generally inadequate description of the soils in the reports of these experiments, it was found impractical to group and analyze the data with relation either to physical or chemical differences in the soils, and the grouping employed—natural productiveness as evidenced by the yields on the unfertilized plats—was chosen as the best available.

*Yield of oats, in bushels per acre, on unfertilized plats when more than one such plat is given.*

| Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. |
|---|---|---|---|---|---|---|---|---|---|
| *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* |
| 9.0 | 10.0 | 18.1 | 18.1 | 22.3 | 24.8 | 26.2 | 35.3 | 36.5 | 48.1 |
| 10.9 | 18.4 | 25.6 | 20.7 | 22.4 | 25.6 | 30.3 | 36.8 | 37.9 | 49.0 |
| 11.5 | 19.3 |  | 21.3 | 22.5 | 27.8 | 31.2 | 38.2 | 44.2 | 49.7 |
| 13.8 | 21.0 | **21.9** | 22.6 | 24.7 | 28.3 | 31.2 | 41.2 | 45.0 | 51.7 |
| 14.4 | 28.8 |  | 23.0 | 25.9 | 28.4 | 32.8 | 45.8 | 46.1 | 56.2 |
|  |  | 20.0 | 23.7 | 26.4 | 29.2 | 33.0 |  | 46.8 | 57.4 |
| **11.9** | **19.5** | 22.0 | 24.8 | 27.0 | 30.0 | 33.6 | **39.5** | 47.5 | 58.6 |
|  |  | 24.0 | 25.2 | 29.8 | 30.3 | 33.7 |  | 48.2 | 59.7 |
| 9.9 | 3.8 |  | 25.3 |  | 32.9 | 33.7 | 28.8 |  |  |
| 14.5 | 14.1 | **22.0** | 26.2 | **25.1** | 33.1 | 35.0 | 37.0 | **44.0** | **53.8** |
| 20.3 | 22.6 |  | 28.3 |  | 33.1 | 35.4 | 39.1 |  |  |
| 20.4 | 23.6 | 22.3 | 28.5 |  | 34.2 | 38.4 | 46.0 |  |  |
| 22.1 | 23.6 | 22.3 | 29.4 | 19.3 | 35.5 | 38.6 | 47.0 | 39.7 |  |
|  | 24.1 | 22.7 | 29.8 | 27.6 | 36.2 | 44.7 |  | 40.4 | 52.5 |
| **17.4** | 24.7 |  |  | 31.0 |  |  | **39.6** | 43.5 | 52.8 |
|  | 25.0 | **22.4** | **24.8** |  | **30.7** | **34.1** |  | 47.5 | 67.5 |
|  |  |  |  | **26.0** |  |  | 28.3 | 58.1 |  |
| 13.7 | **20.2** | 13.7 |  |  | 26.0 | 31.5 | 33.3 |  | **57.6** |
| 19.3 |  | 15.8 |  |  | 27.0 | 34.0 | 41.9 | **45.8** |  |
| 19.3 |  | 18.4 |  | 21.8 | 32.9 | 38.7 | 45.6 |  |  |
|  | 19.5 | 19.4 | 20.2 | 25.9 | 34.8 |  | 48.8 |  |  |
| **17.4** | 21.5 | 20.0 | 20.9 | 27.8 | 40.2 | **34.7** |  | 45.1 | 52.3 |
|  |  | 21.0 | 21.0 | 29.7 |  |  | **39.6** | 46.8 | 55.6 |
|  | **20.5** | 22.6 | 21.4 | 32.8 | **32.2** |  |  | 47.1 | 59.7 |
| 15.0 |  | 23.6 | 24.2 |  |  | 33.1 | 30.4 | 48.3 | 59.8 |
| 20.0 |  | 24.2 | 24.8 | **27.6** |  | 33.4 | 39.3 | 55.5 | 63.1 |
|  | 15.8 | 25.6 | 26.1 |  | 21.8 | 34.4 | 41.3 |  |  |
| **17.5** | 19.2 | 25.6 | 29.9 |  | 30.5 | 34.5 | 44.0 | **48.6** | **58.1** |
|  | 21.2 | 25.9 | 30.2 | 26.3 | 36.2 | 34.5 | 46.0 |  |  |
|  | 22.1 | 28.7 | 31.6 | 29.3 | 37.8 | 34.7 |  |  |  |
| 15.0 | 27.2 | 30.4 |  | 29.6 | 42.5 | 35.0 | **40.2** |  |  |
| 16.7 |  |  | **25.0** |  |  | 35.4 |  | 46.6 |  |
| 17.2 | **21.1** | **22.5** |  | **28.4** | **33.8** | 36.4 | 37.0 | 54.6 |  |
| 17.3 |  |  |  |  |  | 45.6 | 44.0 |  |  |
| 17.5 |  |  |  |  |  |  |  | **50.6** |  |
| 19.7 | 14.1 | 22.1 |  | 22.3 | 26.1 | **35.7** | **40.5** |  |  |
| 20.6 | 16.3 | 23.0 |  | 28.2 | 33.9 |  |  |  |  |
| 20.6 | 21.7 | 23.3 | 22.0 | 31.3 | 35.3 |  | 36.8 |  |  |
| 22.0 | 25.4 | 23.6 | 24.2 | 31.4 | 35.9 | 38.0 | 43.8 | 42.6 |  |
| 22.2 | 31.3 | 25.0 | 29.1 | 34.4 | 38.2 | 40.0 | 46.9 | 60.7 |  |
| **18.9** | **21.8** | **23.4** | **25.1** | **29.5** | **33.9** | **39.0** | **42.5** | **51.7** |  |

It will be seen from this table that the yields of duplicate plats are not all that could be desired for scientific work of this character. With differences so great as these no strict or exact quantitative comparison can be made from observed differences due to fertilizer treatment. This fact must be borne in mind in interpreting or applying the results given in tabular form farther on in this bulletin, and decidedly less weight should be given to the results from a few experiments than to the averages from a great many.

## KINDS AND COST OF THE FERTILIZERS USED.

In computing the relative efficiency, from a commercial standpoint, of the several substances which have been used in the fertilizer tests some arbitrary value must be assigned to each which will represent, as fairly as possible, the average cost to the farmer in the several States. However, when these values for any reason do not represent local market conditions, the data contained in the subsequent tables are sufficient to enable a recalculation to be made on any new basis of value.

The values used in computing the commercial efficiency of fertilizers in this bulletin are given in the following table.

The cost of fertilizers given in succeeding tables is based upon the values assigned the several substances in the following table. In a number of cases it was found impracticable to determine the value of substances used, but in all such cases these tests have been eliminated in computing the average profit or loss.

*Valuation of fertilizer ingredients used in plat tests on oat soils.*

| Ingredient. | Cost per ton. | Ingredient. | Cost per ton. |
|---|---|---|---|
| Nitrate of soda | $50.00 | Basic slag | $12.50 |
| Sulphate of ammonia | 62.00 | Sulphate of potash-magnesia | (a) |
| Acid phosphate | 14.00 | Niterlime | (a) |
| Rock phosphate | 9.00 | Dried blood | 40.00 |
| Nitrate of potash | 50.00 | Tankage | 26.00 |
| Sulphate of potash | 60.00 | Boneblack | 22.00 |
| Muriate of potash | 44.00 | Ground bone | 26.00 |
| Kainit | 12.00 | Cotton seed | 16.00 |
| Krugit | (a) | Cotton-seed meal | 25.00 |
| Sulphate of iron | (a) | Cotton-seed hull ashes | 34.00 |
| Wood ashes | 5.00 | Muck | (a) |
| Lime | 6.00 | Seaweed | (a) |
| Gypsum | 8.00 | Wheat bran | (a) |
| Salt | 8.00 | Manure | .50 |
| Floats | 8.00 | Commercial fertilizer | 20.00 |

[a] Not valued.

## VALUE ASSIGNED THE GRAIN.

For the purposes of this comparative study the farm value of oats has been taken as 47 cents per bushel, which is approximately the average value given by the Bureau of Statistics for the year 1908, as reported in the Yearbook of the Department of Agriculture for that year, page 626.

## TABULATION OF RESULTS.

The following table gives a complete summary of the results of the fertilizer tests on oat soils. The first column of figures indicates the number of experiments which have been reported, with each substance tried. The actual experiment was usually performed on one-twentieth or one-tenth acre plats, but the results are uniformly stated in pounds per acre, both in case of fertilizers applied and in crop returns, and this unit is retained throughout this bulletin. The second column of figures shows the relative number of increases to no increase reported from the use of the several fertilizers.

The third column of figures shows the extreme range of effectiveness of the several fertilizers within the limit of the observations which have been made. The sixth column gives the average increase or decrease in pounds per acre attributable to the fertilizers used. This information, together with the average amount of fertilizer used per acre and its cost and the value of the increased production, gives the basis for calculating the average gain or loss in money value, except that in no case has any allowance been made for the cost of applying the fertilizers to the land.

*Results of fertilizer tests with oat soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Nitrate of soda | 56 | 3.3 : 1 | −30.0 to 35.0 | 182 | 4.54 | 7.3 | 3.43 | −1.11 |
| Sulphate of ammonia | 8 | 3.0 : 1 | − 1.9 to 28.0 | 205 | 6.35 | 11.8 | 5.55 | − .80 |
| Acid phosphate | 81 | 3.1 : 1 | −22.0 to 28.1 | 294 | 2.06 | 3.6 | 1.69 | − .37 |
| Rock phosphate | 4 | 0.3 : 1 | − 7.7 to 11.7 | 460 | 2.07 | −0.5 | − .23 | −2.30 |
| Nitrate of potash | 2 | 2.0 : 0 | 3.8 to 5.7 | 350 | 8.75 | 4.7 | 2.21 | −6.54 |
| Sulphate of potash | 3 | 0.5 : 1 | − 3.1 to 3.9 | 197 | 5.91 | 0.07 | .03 | −5.88 |
| Muriate of potash | 60 | 2.2 : 1 | − 7.2 to 15.5 | 160 | 3.52 | 1.6 | .75 | −2.77 |
| Kainit | 7 | 2.5 : 1 | − 6.5 to 13.7 | 407 | 2.44 | 6.3 | 2.96 | .52 |
| Krugit | 1 | 0.0 : 1 | −4.7 | 800 | ....... | [a]−4.7 | [a]−2.21 | ......... |
| Sulphate of iron | 1 | 0.0 : 1 | −3.0 | 58 | ....... | [a]−3.0 | [a]−1.41 | ......... |
| Wood ashes | 1 | 1.0 : 0 | 6.7 | 750 | 1.87 | 6.7 | 3.15 | 1.28 |
| Lime | 62 | 1.0 : 1 | −13.8 to 17.9 | 2,998 | 8.99 | 1.0 | .47 | −8.52 |
| Gypsum | 60 | 0.8 : 1 | −17.6 to 31.5 | 337 | 1.35 | 1.4 | .66 | − .69 |
| Salt | 8 | 3.0 : 1 | − 8.0 to 19.5 | 252 | 1.01 | 4.2 | 1.97 | .96 |
| Total and averages | 354 | 1.8 : 1 | ............... | ......... | 3.96 | 3.2 | 1.50 | −2.46 |

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Bush. | Dolls. | Dolls. |
|---|---|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate | 49 | 11.2 : 1 | −14.5 to 40.1 | 176<br>260 | 6.23 | 11.8 | 5.55 | −0.68 |
| Nitrate of soda<br>Floats | 1 | 1.0 : 0 | 19.0 | 200<br>200 | 5.80 | 19.0 | 8.93 | 3.13 |
| Nitrate of soda<br>Muriate of potash | 38 | 11.7 : 1 | − 1.1 to 21.7 | 166<br>110 | 6.56 | 8.0 | 3.76 | −2.80 |
| Sulphate of ammonia<br>Acid phosphate | 5 | 5.0 : 0 | 2.9 to 26.8 | 168<br>190 | 6.54 | 13.9 | 6.53 | − .01 |
| Sulphate of ammonia<br>Muriate of potash | 5 | 5.0 : 0 | 3.0 to 9.2 | 198<br>113 | 8.62 | 6.0 | 2.82 | −5.80 |

[a] Not included in averages, as cost of fertilizer is not shown.

*Results of fertilizer tests with oat soils*—Continued.

### MIXTURES OF TWO MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 15.5 | 300<br>300 | 11.10 | 15.5 | 7.29 | − 3.81 |
| Acid phosphate<br>Muriate of potash | 138 | 5.9 : 1 | −28.0 to 32.4 | 276<br>160 | 5.46 | 8.0 | 3.76 | − 1.70 |
| Acid phosphate<br>Kainit | 2 | 2.0 : 0 | .9 to 16.6 | 123<br>171 | 1.89 | 8.7 | 4.09 | 2.20 |
| Total and averages | 239 | 7.9 : 1 | | | 5.88 | 9.0 | 4.23 | − 1.65 |

### MIXTURES OF THREE OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 200 | 19.0 : 1 | − 9.5 to 42.5 | 272<br>243<br>133 | 11.42 | 11.3 | 5.31 | − 6.11 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 2 | 2.0 : 0 | 2.2 to 11.8 | 170<br>270<br>170 | 7.16 | 7.0 | 3.29 | − 3.87 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash-magnesia | 2 | 2.0 : 0 | 2.9 to 4.8 | 290<br>500<br>480 | | [a] 3.8 | 1.79 | |
| Nitrate of soda<br>Rock phosphate<br>Muriate of potash | 7 | 7.0 : 0 | 5.3 to 12.2 | 160<br>250<br>80 | 6.88 | 8.2 | 3.85 | − 3.03 |
| Nitrate of soda<br>Basic slag<br>Muriate of potash | 13 | 13.0 : 0 | 1.7 to 23.7 | 160<br>168<br>86 | 6.94 | 9.9 | 4.65 | − 2.29 |
| Niterlime<br>Acid phosphate<br>Muriate of potash | 1 | 0.0 : 1 | −2.3 | 160<br>320<br>80 | | [a] −2.3 | −1.08 | |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash-magnesia | 2 | 1.0 : 1 | − 9.1 to 11.9 | 225<br>500<br>485 | | [a] 2.8 | 1.32 | |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 115 | 10.5 : 1 | − 7.0 to 34.0 | 232<br>286<br>165 | 12.82 | 10.1 | 4.75 | − 8.07 |
| Sulphate of ammonia<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 28.6 | 150<br>150<br>150 | 6.60 | 28.6 | 13.44 | 6.84 |
| Sulphate of ammonia<br>Rock phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 16.5 | 200<br>300<br>100 | 9 75 | 16.5 | 7.75 | − 2.00 |
| Nitrate of soda<br>Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 2.5 | 150<br>150<br>300<br>400 | 22.50 | 2.5 | 1.17 | −21.33 |
| Total and averages | 345 | 14.7 : 1 | | | 11.62 | 10.8 | 5.08 | − 6.54 |

### ORGANIC FERTILIZERS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Dried blood | 27 | 0.5 : 1 | − 8.6 to 10.5 | 224 | 4.48 | −0.6 | −0.28 | − 4.76 |
| Tankage | 2 | 1.0 : 1 | −18.9 to 22.4 | 550 | 7.55 | 1.7 | .80 | − 6.35 |
| Boneblack | 3 | 2.0 : 1 | − .3 to 8.2 | 353 | 3.89 | 3.7 | 1.74 | − 2.15 |
| Ground bone | 13 | 3.3 : 1 | −21.0 to 22.5 | 445 | 5.79 | 6.7 | 3.15 | − 2.64 |
| Cotton seed | 6 | 6.0 : 0 | 1.3 to 42.7 | 1,863 | 14.91 | 19.3 | 9.07 | − 5.84 |
| Cotton-seed meal | 13 | 5.5 : 1 | − 9.7 to 30.9 | 402 | 5.03 | 9.1 | 4.28 | − .75 ✓ |
| Linseed meal | 7 | 2.5 : 1 | − 8.3 to 7.9 | 1,114 | 21.17 | 2.8 | 1.32 | −19.85 |
| Muck | 1 | 1.0 : 0 | 1.6 | 12,000 | | [a] 1.6 | .75 | |
| Seaweed | 2 | 1.0 : 1 | − 6.3 to .4 | 9 cords | | [a] −2.9 | 1.36 | |
| Total and averages | 74 | 1.7 : 1 | | | 7.40 | 4.8 | 2.26 | − 5.14 |

[a] Not included in averages, as cost of fertilizer is not shown.

*Results of fertilizer tests with oat soils*—Continued.

ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Dried blood<br>Acid phosphate | 31 | 14.5 : 1 | − 2.4 to 21.0 | 222<br>294 | 6.49 | 5.6 | 2.63 | − 3.86 |
| Dried blood<br>Muriate of potash | 27 | 2.0 : 1 | −10.8 to 8.0 | 221<br>194 | 8.69 | 1.5 | .70 | − 7.99 |
| Boneblack<br>Muriate of potash | 2 | 2.0 : 0 | 1.6 to 11.9 | 300<br>150 | 6.60 | 6.8 | 3.20 | − 3.40 |
| Cotton seed<br>Acid phosphate | 2 | 2.0 : 0 | 8.7 to 13.4 | 900<br>300 | 9.30 | 11.0 | 5.17 | − 4.13 |
| Cotton seed<br>Cotton-seed meal | 1 | 1.0 : 0 | 9.6 | 900<br>100 | 8.45 | 9.6 | 4.51 | − 3.94 |
| Cotton-seed meal<br>Acid phosphate | 12 | 11.0 : 1 | − 1.4 to 52.2 | 363<br>193 | 5.88 | 15.9 | 7.47 | 1.59 |
| Cotton-seed meal<br>Kainit | 2 | 2.0 : 0 | 6.1 to 18.9 | 415<br>184 | 6.28 | 12.5 | 5.87 | − .41 |
| Cotton-seed meal<br>Cotton-seed hull ashes | 2 | 2.0 : 0 | 4.2 | 200<br>80 | 3.86 | 2.2 | 1.03 | − 2.83 |
| Total and averages | 79 | 5.6 : 1 | ........ | ........ | 7.18 | 6.0 | 2.82 | − 4.36 |

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate<br>Muriate of potash | 143 | 70.5 : 1 | 1.9 to 28.3 | 422<br>284<br>186 | 14.62 | 9.1 | 4.28 | −10.34 |
| Dried blood<br>Acid phosphate<br>Sulphate of potash-magnesia | 2 | 1.0 : 1 | − .9 to 8.2 | 430<br>500<br>485 | ...... | [a]3.7 | 1.74 | .......... |
| Dried blood<br>Ground bone<br>Muriate of potash | 31 | 9.3 : 1 | − 8.0 to 25.0 | 229<br>234<br>194 | 11.89 | 9.3 | 4.37 | − 7.52 |
| Nitrate of soda<br>Boneblack<br>Muriate of potash | 1 | 1.0 : 0 | 18.2 | 160<br>70<br>80 | 6.53 | 18.2 | 8.55 | 2.02 |
| Boneblack<br>Sulphate of ammonia<br>Muriate of potash | 2 | 2.0 : 0 | 13.1 to 14.4 | 100<br>79<br>60 | 4.86 | 13.7 | 6.44 | 1.58 |
| Ground bone<br>Nitrate of soda<br>Muriate of potash | 8 | 8.0 : 0 | 8.8 to 17.6 | 55<br>150<br>80 | 6.23 | 13.1 | 6.16 | − .07 |
| Sulphate of ammonia<br>Ground bone<br>Muriate of potash | 3 | 2.0 : 1 | − .2 to 20.5 | 160<br>320<br>100 | 11.32 | 9.1 | 4.28 | − 7.04 |
| Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 13 | 12.0 : 1 | − 4.0 to 18.0 | 417<br>320<br>171 | 11.23 | 11.8 | 5.55 | − 4.86 |
| Cotton-seed meal<br>Acid phosphate<br>Kainit | 11 | 11.0 : 0 | 0.6 to 29.5 | 357<br>165<br>223 | 6.96 | 14.3 | 6.72 | − 0.24 |
| Cotton-seed meal<br>Rock phosphate<br>Cotton-seed hull ashes | 2 | 1.0 : 1 | − 5.1 to 5.7 | 200<br>400<br>80 | 6.66 | .3 | .14 | − 6.52 |
| Linseed meal<br>Acid phosphate<br>Muriate of potash | 8 | 8.0 : 0 | 1.4 to 24.2 | 500<br>30<br>75 | 11.36 | 10.1 | 4.75 | − 6.61 |
| Wheat bran<br>Nitrate of soda<br>Muriate of potash | 8 | 7.0 : 1 | − 1.6 to 20.0 | 500<br>80<br>65 | ...... | [a]9.6 | 4.51 | .......... |
| Boneblack<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 11.7 | 30<br>80<br>340<br>15 | 5.52 | 11.7 | 5.50 | − .02 |

[a] Not included in averages, as cost of fertilizer is not shown.

*Results of fertilizer tests with oat soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Tankage<br>Ground bone<br>Nitrate of soda<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 15.1 | 100<br>100<br>100<br>100<br>403<br>74 | 12.65 | 15.1 | 7.10 | − 5.65 |
| Cotton-seed meal<br>Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 5.5 | 200<br>100<br>200<br>50 | 7.50 | 5.5 | 2.59 | − 4.91 |
| Total and averages | 235 | 22.5 : 1 | | | 12.92 | 9.7 | 4.56 | − 8.36 |

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Manure | 120 | 29.0 : 1 | − 4.8 to 34.0 | 17,015 | 4.25 | 8.8 | 4.14 | − 0.11 |
| Manure<br>Acid phosphate | 3 | 3.0 : 0 | 15.8 to 20.4 | 10,667<br>160 | 3.79 | 18.0 | 8.46 | 4.67 |
| Manure<br>Lime | 15 | 15.0 : 0 | .9 to 14.6 | 12,667<br>3,797 | 14.55 | 7.9 | 3.71 | −10.84 |
| Manure<br>Nitrate of soda<br>Acid phosphate | 2 | 2.0 : 0 | 1.6 to 1.9 | 8,000<br>320<br>160 | 11.12 | 1.7 | .80 | −10.32 |
| Total and averages | 140 | 34.0 : 1 | | | 5.45 | 8.8 | 4.14 | − 1.31 |

COMMERCIAL FERTILIZER.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dolls.* |
| Commercial fertilizer | 17 | 16.0 : 1 | − 4.5 to 19.7 | 514 | 5.14 | 7.8 | 3.67 | − 1.47 |

The actual number of cases in each class of fertilizer used, showing an increase in production and no increase, are given in the following table:

*Actual number of increases and no increases with each class of fertilizer, together with the ratio and the average increase of crop.*

| Fertilizer. | Number of experiments. | Increases. | No increase. | Increase to no increase. | Average increase per acre. |
|---|---|---|---|---|---|
| | | | | *Ratio.* | *Bushels.* |
| Minerals alone | 354 | 226 | 128 | 1.7 : 1 | 3.2 |
| Minerals in combinations of two | 239 | 212 | 27 | 7.9 : 1 | 9.0 |
| Minerals in combinations of three or more | 345 | 323 | 22 | 14.7 : 1 | 10.8 |
| Organic fertilizers alone | 74 | 47 | 27 | 1.7 : 1 | 4.8 |
| Organic fertilizers in combination with one mineral | 79 | 67 | 12 | 5.6 : 1 | 6.0 |
| Organic fertilizers in combination with two or more minerals | 235 | 225 | 10 | 22.5 : 1 | 9.7 |
| Manure alone and in combinations | 140 | 136 | 4 | 34.0 : 1 | 8.8 |
| Commercial fertilizers | 17 | 16 | 1 | 16.0 : 1 | 7.8 |
| Total | 1,483 | 1,252 | 231 | 5.4 : 1 | 7.7 |

## EFFECTIVENESS OF SINGLE SUBSTANCES AND MIXTURES.

Notwithstanding what has been said about the wide variations of check plats and the wide range in crop increases with all the fertilizers, the general conclusion that the chances for increased yields increase with the number of substances used in the mixture, at least up to three substances, seems so consistent and regular that there can be little doubt of its correctness.

To examine further this point, several of the single fertilizers and their combinations have been brought together in the following table, showing both the sum of the increases attributable to the single fertilizers and the increases due to the combination of two or three substances:

*Increase in yield of oats per acre, due to single fertilizers, compared with increase due to mixtures of these fertilizers.*

| Fertilizer. | Number of experiments. | Increase per acre. |
|---|---|---|
| | | *Bushels.* |
| Nitrate of soda | 56 | 7.3 |
| Acid phosphate | 81 | 3.6 |
| Total | | 10.9 |
| Mixture of the two | 49 | 11.8 |
| Nitrate of soda | 56 | 7.3 |
| Muriate of potash | 60 | 1.6 |
| Total | | 8.9 |
| Mixture of the two | 38 | 8.0 |
| Acid phosphate | 81 | 3.6 |
| Muriate of potash | 60 | 1.6 |
| Total | | 5.2 |
| Mixture of the two | 138 | 8.0 |
| Nitrate of soda | 56 | 7.3 |
| Acid phosphate | 81 | 3.6 |
| Muriate of potash | 60 | 1.6 |
| Total | | 12.5 |
| Mixture of the three | 200 | 11.3 |
| Sulphate of ammonia | 8 | 11.7 |
| Acid phosphate | 81 | 3.6 |
| Muriate of potash | 60 | 1.6 |
| Total | | 16.9 |
| Mixture of the three | 115 | 10.1 |
| Dried blood | 27 | — 0.6 |
| Acid phosphate | 81 | 3.6 |
| Total | | 3.0 |
| Mixture of the two | 31 | 5.6 |
| | | *Bushels.* |
| Dried blood | 27 | — 0.6 |
| Muriate of potash | 60 | 1.6 |
| Total | | 1.0 |
| Mixture of the two | 27 | 1.5 |
| Cotton-seed meal | 13 | 9.1 |
| Acid phosphate | 81 | 3.6 |
| Total | | 12.7 |
| Mixture of the two | 12 | 15.9 |
| Dried blood | 27 | — 0.6 |
| Acid phosphate | 81 | 3.6 |
| Muriate of potash | 60 | 1.6 |
| Total | | 4.6 |
| Mixture of the three | 143 | 9.1 |
| Dried blood | 27 | — 0.6 |
| Ground bone | 13 | 6.7 |
| Muriate of potash | 60 | 1.6 |
| Total | | 7.7 |
| Mixture of the three | 31 | 9.3 |
| Cotton-seed meal | 13 | 9.1 |
| Acid phosphate | 81 | 3.6 |
| Muriate of potash | 60 | 1.6 |
| Total | | 14.3 |
| Mixture of the three | 13 | 11.8 |

It will be observed that the data contained in this table embrace all observations which have been reported on all soils and in all seasons, both for the single substances and for the several mixtures. There is, on the whole, an apparent tendency toward an additive effect, each substance in the mixture having its own effect as it would have were the other substances not present. Whether and to what extent each substance may modify the effect of another or be modified by it can not be determined from the data.

## EFFECT OF USING INCREASED AMOUNTS OF FERTILIZER.

The following table contains all the data available to determine the effect of increasing the amount of fertilizer applied to the soil. All experiments on any soil and in any year when the amount of nitrate of soda applied, for example, is between 100 and 149 pounds per acre are summed up and weighted averages obtained. The number of experiments is given in each case with the absolute range of crop increase.

*Increase in yield of oats attributable to different amounts of fertilizers.*

| Fertilizer. | Quantity per acre. | Number of experiments. | Range of effects as shown in yields. | Average change in yield per acre. |
|---|---|---|---|---|
| | *Pounds.* | | *Bushels.* | *Bushels.* |
| Nitrate of soda | Below 100 | 3 | 5.3 to 11.3 | 7.4 |
| | 100 to 149 | 6 | 12.0 to 27.1 | 16.6 |
| | 150 to 199 | 31 | −30.0 to 10.9 | 2.0 |
| | 200+ | 16 | − 8.7 to 35.0 | 13.8 |
| Acid phosphate | Below 100 | 12 | − .1 to 13.0 | 7.1 |
| | 100 to 149 | 3 | − 8.4 to 3.9 | − .5 |
| | 150 to 199 | 3 | 2.2 to 8.3 | 5.8 |
| | 200 to 249 | 1 | −5.3 | − 5.3 |
| | 250 to 299 | 13 | − 1.5 to 17.2 | 4.2 |
| | 300 to 349 | 30 | − 4.7 to 13.2 | 2.9 |
| | 350 to 399 | 8 | − 6.6 to 28.1 | 4.8 |
| | 400+ | 11 | −22.0 to 11.2 | 1.5 |
| Muriate of potash | Below 99 | 17 | − 7.2 to 8.1 | 1.1 |
| | 100 to 149 | ........ | ........ | ........ |
| | 150 to 199 | 24 | − 6.2 to 15.5 | 2.3 |
| | 200 to 249 | 17 | − 4.6 to 7.3 | 4.0 |
| | 250 to 299 | ........ | ........ | ........ |
| | 300+ | 2 | 4.7 to 14.4 | 9.5 |
| Lime | Below 1,000 | 8 | − 2.1 to 9.4 | 3.7 |
| | 1,000 to 1,499 | 7 | − 6.4 to 16.0 | 5.1 |
| | 1,500 to 1,999 | 6 | − 1.8 to 6.8 | 3.0 |
| | 2,000 to 3,999 | ........ | ........ | ........ |
| | 4,000+ | 41 | −13.8 to 17.9 | − .7 |
| Gypsum | Below 300 | 2 | − .5 to 5.3 | 2.4 |
| | 300 to 349 | 48 | −13.0 to 31.5 | 1.2 |
| | 350 to 399 | ........ | ........ | ........ |
| | 400 to 449 | 7 | − 4.8 to 10.1 | 2.9 |
| | 450 to 499 | ........ | ........ | ........ |
| | 500+ | 3 | −17.6 to 9.3 | − .2 |
| Dried blood | Below 200 | 8 | − 6.8 to 10.5 | − .2 |
| | 200 to 249 | 16 | − 8.6 to 4.2 | − 1.4 |
| | 250 to 299 | 1 | 1.2 | 1.2 |
| | 300+ | 2 | − .9 to 6.0 | 2.5 |
| Manure | Below 5,000 | 3 | 4.9 to 9.6 | 7.3 |
| | 5,000 to 9,999 | 9 | .5 to 18.6 | 9.2 |
| | 10,000 to 14,999 | 34 | 1.3 to 15.8 | 6.7 |
| | 15,000 to 19,999 | 38 | − 4.8 to 26.7 | 8.0 |
| | 20,000+ | 36 | .4 to 41.1 | 11.7 |

It will be observed that the results are quite irregular, as would be expected from the small number of experiments in some of the grades and by the wide range in crop increases. There is, on the whole, no indication of any consistent or regular increase in productivity with increasing amounts of fertilizer used. In most cases it would be unsafe to assume that the larger application of fertilizers would give larger increases than the smallest or next to the smallest application shown in the table.

## RELATION OF FERTILIZER EFFECT AND NATURAL PRODUCTIVENESS OF SOIL.

In order to determine, if possible, whether the effectiveness of the fertilizers is dependent in any marked way upon the natural productivity of the soil, all available data have been brought together in the following table:

*Increase in yield of oats attributable to fertilizers, arranged in accordance with the actual yield of the check plats.*

| Fertilizer. | Yield of unfertilized plats. | Number of experiments. | Range of effects as shown in yields per acre. | Average change in yield per acre. |
|---|---|---|---|---|
| | *Bushels.* | | *Bushels.* | *Bushels.* |
| Nitrate of soda ✓ | Below 10.0 | 1 | 9.2 | 9.2 |
| | 10 to 19.9 | 15 | 1.1 to 35.0 | 14.5 |
| | 20 to 29.9 | 14 | −4.2 to 23.0 | 8.7 |
| | 30 to 39.9 | 11 | −1.4 to 16.7 | 5.9 |
| | 40 to 49.9 | 5 | −2.2 to 6.8 | 1.7 |
| | 50 to 59.9 | 6 | −8.7 to 9.7 | 1.9 |
| | 60 to 69.9 | 1 | −5.1 | −5.1 |
| | 70+ | 3 | −4.0 to 30.0 | 12.8 |
| Acid phosphate ✓ | Below 10.0 | 3 | 1.9 to 12.9 | 6.4 |
| | 10 to 19.9 | 11 | −.1 to 28.1 | 7.0 |
| | 20 to 29.9 | 22 | .4 to 13.2 | 5.2 |
| | 30 to 39.9 | 24 | −5.3 to 17.2 | 3.7 |
| | 40 to 49.9 | 11 | −3.6 to 11.6 | 3.2 |
| | 50 to 59.9 | 10 | −8.4 to 12.6 | .5 |
| | 80+ | 1 | 7.5 | 7.5 |
| Muriate of potash ✓ | 10 to 19.9 | 6 | −3.5 to 14.4 | 1.9 |
| | 20 to 29.9 | 19 | −7.2 to 8.1 | 1.7 |
| | 30 to 39.9 | 19 | −4.6 to 7.3 | 1.3 |
| | 40 to 49.9 | 10 | −2.9 to 15.5 | 4.1 |
| | 50 to 59.9 | 5 | −4.0 to 5.5 | −.3 |
| | 80+ | 1 | 6.2 | 6.2 |
| Lime | Below 10.0 | 3 | −.1 to 6.8 | 4.5 |
| | 10 to 19.9 | 16 | −5.0 to 6.4 | .2 |
| | 20 to 29.9 | 9 | −13.8 to 16.0 | −1.4 |
| | 30 to 39.9 | 20 | −8.8 to 9.4 | 2.2 |
| | 40 to 49.9 | 12 | −2.2 to 11.5 | 3.7 |
| | 50 to 59.9 | 4 | −4.4 to 2.0 | −.8 |
| | 60+ | 2 | −6.4 to −.6 | −3.5 |
| Gypsum | 10 to 19.9 | 8 | −1.9 to 13.7 | 1.9 |
| | 20 to 29.9 | 13 | −8.8 to 12.0 | 1.7 |
| | 30 to 39.9 | 21 | −9.7 to 31.5 | 1.9 |
| | 40 to 49.9 | 10 | −13.0 to 10.1 | −1.4 |
| | 50+ | 7 | −17.6 to 15.5 | 3.1 |
| Nitrate of soda and acid phosphate ✓ | Below 10.0 | 6 | 6.1 to 18.3 | 12.9 |
| | 10 to 19.9 | 9 | −.7 to 40.1 | 17.4 |
| | 20 to 29.9 | 12 | 5.0 to 19.6 | 12.2 |
| | 30 to 39.9 | 13 | −14.5 to 17.8 | 9.3 |
| | 40 to 49.9 | 5 | −4.4 to 13.8 | 4.7 |
| | 50 to 59.9 | 3 | 11.8 to 16.0 | 14.4 |
| | 80+ | 1 | 12.5 | 12.5 |
| Nitrate of soda and muriate of potash ✓ | 10 to 19.9 | 5 | −.3 to 21.7 | 10.7 |
| | 20 to 29.9 | 14 | −1.1 to 14.9 | 7.3 |
| | 30 to 39.9 | 10 | .9 to 13.0 | 7.1 |
| | 40 to 49.9 | 5 | 3.1 to 8.8 | 5.5 |
| | 50 to 59.9 | 3 | 13.0 to 19.9 | 15.8 |
| | 80+ | 1 | 2.5 | 2.5 |
| Acid phosphate and muriate of potash ✓ | Below 10.0 | 2 | 6.5 to 9.0 | 7.8 |
| | 10 to 19.9 | 20 | 5.2 to 32.3 | 15.7 |
| | 20 to 29.9 | 48 | −4.1 to 21.4 | 7.5 |
| | 30 to 39.9 | 40 | −6.5 to 22.4 | 7.2 |
| | 40 to 49.9 | 18 | −.7 to 20.6 | 8.3 |
| | 50 to 59.9 | 12 | −15.0 to 15.7 | .5 |
| | 80+ | 1 | 2.6 | 2.6 |

*Increase in yield of oats attributable to fertilizers, etc.*—Continued.

| Fertilizer. | Yield of unfertilized plats. | Number of experiments. | Range of effects as shown in yields per acre. | Average change in yield per acre. |
|---|---|---|---|---|
| | *Bushels.* | | *Bushels.* | *Bushels.* |
| Nitrate of soda, acid phosphate, and muriate of potash | Below 10.0 | 3 | 13.0 to 19.3 | 15.9 |
| | 10 to 19.9 | 17 | 1.2 to 42.5 | 16.5 |
| | 20 to 29.9 | 71 | .9 to 34.6 | 13.2 |
| | 30 to 39.9 | 65 | − 9.5 to 25.4 | 10.1 |
| | 40 to 49.9 | 22 | − 5.0 to 21.9 | 7.8 |
| | 50 to 59.9 | 21 | − 3.3 to 20.1 | 7.4 |
| | 80+ | 1 | 16.3 | 16.3 |
| Sulphate of ammonia, acid phosphate, and muriate of potash | Below 10.0 | 3 | 8.0 to 13.8 | 10.9 |
| | 10 to 19.9 | 13 | 2.3 to 34.0 | 15.1 |
| | 20 to 29.9 | 28 | 4.0 to 23.0 | 11.4 |
| | 30 to 39.9 | 41 | − 2.3 to 23.3 | 9.8 |
| | 40 to 49.9 | 14 | 4.7 to 26.9 | 10.4 |
| | 50+ | 12 | − 7.0 to 27.2 | 6.0 |
| Dried blood | 10 to 19.9 | 4 | − 2.6 to 10.5 | 1.2 |
| | 20 to 29.9 | 9 | − 6.8 to 1.0 | − 1.8 |
| | 30 to 39.9 | 8 | − 8.6 to 6.0 | − .6 |
| | 40 to 49.9 | 4 | 1.2 to 3.9 | 2.1 |
| | 50+ | 2 | − 6.1 to 1.4 | − 2.3 |
| Dried blood and acid phosphate | 10 to 19.9 | 6 | 2.7 to 9.4 | 5.4 |
| | 20 to 29.9 | 8 | 2.9 to 9.0 | 6.5 |
| | 30 to 39.9 | 11 | − 2.4 to 11.0 | 3.7 |
| | 40 to 49.9 | 3 | .3 to 21.0 | 9.2 |
| | 50+ | 1 | 3.9 | 3.9 |
| Dried blood and muriate of potash | 10 to 19.9 | 4 | − 1.0 to 5.1 | 2.0 |
| | 20 to 29.9 | 7 | .5 to 5.4 | 3.0 |
| | 30 to 39.9 | 10 | −10.8 to 6.9 | − .03 |
| | 40 to 49.9 | 4 | − 4.6 to 7.1 | − .7 |
| | 50+ | 2 | 5.1 to 8.0 | 6.6 |
| Dried blood, acid phosphate, and muriate of potash. | Below 10.0 | 3 | 11.5 to 16.5 | 13.5 |
| | 10 to 19.9 | 19 | 5.8 to 14.5 | 10.2 |
| | 20 to 29.9 | 38 | 3.1 to 19.0 | 11.6 |
| | 30 to 39.9 | 50 | 1.1 to 22.4 | 8.4 |
| | 40 to 49.9 | 22 | − 1.9 to 21.1 | 8.3 |
| | 50+ | 10 | .7 to 28.3 | 8.4 |
| Dried blood, ground bone, and muriate of potash | 10 to 19.9 | 7 | 4.3 to 25.0 | 11.2 |
| | 20 to 29.9 | 6 | 6.3 to 21.1 | 14.0 |
| | 30 to 39.9 | 10 | − 8.0 to 15.9 | 6.6 |
| | 40 to 49.9 | 6 | − 1.8 to 21.6 | 8.4 |
| | 50+ | 2 | 4.0 to 6.6 | 5.3 |
| Manure | Below 10.0 | 1 | 1.3 | 1.3 |
| | 10 to 19.9 | 17 | 5.4 to 21.4 | 11.4 |
| | 20 to 29.9 | 29 | − 4.8 to 34.0 | 10.0 |
| | 30 to 39.9 | 45 | − 2.9 to 33.5 | 8.0 |
| | 40 to 49.9 | 16 | − 1.2 to 13.6 | 4.9 |
| | 50+ | 15 | .4 to 27.0 | 10.8 |

While there is considerable irregularity in the results, as would be expected from the great differences in the range of increase, there is no indication of any consistent difference in the increase from the different classes of soils.

It seems evident from the foregoing that the fertilizers have yielded about the same increase in crop on all classes of soils, basing the class in this case on the yield of the unfertilized plat.

## SUMMARY.

It appears from the foregoing that the experiment stations have reported the results of 1,483 experiments with fertilizers on oat soils.

The duplicate check plats show such wide variations that considerable latitude must be allowed in the interpretation of all results, and quantitative comparisons should not be given too great weight.

The chances for increase in crop production are greater with two or three fertilizers mixed than with a single substance, and the larger increase gives in general a larger financial gain.

The increase in yield due to mixtures of minerals approximates an additive effect, the increase due to the mixtures being approximately equal to the sum of the increases due to the individual fertilizers.

It appears that the smaller applications of single fertilizers, manure, and commercial fertilizers have given in general no less an increase than the larger amounts. The increases obtained from the more productive soils, based upon the yield of the unfertilized plats, appear to be less than from the less productive soils.

The data contained in the station reports do not permit one to judge of the cumulative effect of the continued use of fertilizers on the same soil for a long series of years.

As these results have been obtained from a large number of soils, with a considerable range of productivity, over a number of years, these general conclusions, besides others of a qualitative value which can be drawn from the tables, can, in the absence of any more specific knowledge of any particular soil, be safely followed as a guide to the immediate selection of fertilizers for a soil upon which oats are to be grown.

## FERTILIZERS ON SOILS USED FOR HAY.

There have been 1,263 tests of substances applied to soils upon which hay has been produced, the results paralleling those for oats and making unnecessary more than a mere presentation of data.

The following table shows the number of individual tests in each year:

*Number of individual tests on hay soils arranged according to years.*

| Year. | Number. | Year. | Number. | Year. | Number. |
|---|---|---|---|---|---|
| 1868 | 10 | 1890 | 54 | 1901 | 54 |
| 1869 | 34 | 1891 | 37 | 1902 | 148 |
| 1881 | 41 | 1892 | 28 | 1903 | 49 |
| 1882 | 18 | 1893 | 72 | 1904 | 23 |
| 1883 | 29 | 1894 | 35 | 1905 | 46 |
| 1884 | 13 | 1895 | 31 | 1906 | 27 |
| 1885 | 15 | 1896 | 31 | 1907 | 13 |
| 1886 | 131 | 1897 | 33 | | |
| 1887 | 59 | 1898 | 19 | Total | 1,263 |
| 1888 | 71 | 1899 | 6 | | |
| 1889 | 107 | 1900 | 29 | | |

The following table shows the number of tests which have been reported for each State:

*Fertilizer plat tests on hay soils, arranged according to the number of individual tests made in each State.*

| State. | Number. | State. | Number. |
|---|---|---|---|
| Pennsylvania | 618 | New Hampshire | 20 |
| Maryland | 128 | Wisconsin | 17 |
| New York | 96 | Kentucky | 12 |
| Massachusetts | 67 | Missouri | 7 |
| Tennessee | 58 | Kansas | 6 |
| California | 58 | Delaware | 6 |
| New Jersey | 53 | Michigan | 3 |
| North Carolina | 35 | Indiana | 1 |
| Connecticut | 31 | | |
| Maine | 25 | Total | 1,263 |
| Illinois | 22 | | |

The following table gives the yield of the check plats when more than one such plat is given and separately reported:

*Yield of hay, in pounds per acre, on unfertilized plats when more than one such plat is given.*

| Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. |
|---|---|---|---|---|---|---|---|---|---|
| *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| 122<br>145<br>584<br>**284** | 64<br>520<br>660<br>1,480<br>2,127<br>**970** | 640<br>724<br>1,120<br>1,688<br>2,520<br>**1,338** | 2,000<br>2,040<br>2,100<br>**2,047** | 1,800<br>2,720<br>**2,260** | 2,280<br>2,480<br>2,600<br>2,780<br>2,940<br>3,260<br>3,280<br>3,420<br>**2,880** | 2,600<br>2,800<br>2,800<br>4,000<br>4,400<br>**3,320** | 3,300<br>3,500<br>**3,400** | 2,276<br>3,256<br>3,380<br>3,680<br>5,560<br>**3,630** | 2,816<br>4,120<br>4,256<br>4,400<br>6,560<br>**4,430** |
| 272<br>303<br>840<br>**472** | 720<br>1,080<br>1,220<br>**1,007** | 800<br>1,000<br>1,000<br>2,000<br>2,200<br>**1,400** | 1,860<br>2,280<br>**2,070** | 1,920<br>2,819<br>**2,369** | 2,560<br>2,600<br>2,880<br>3,040<br>3,920<br>**3,000** | 2,104<br>2,904<br>3,568<br>3,728<br>4,328<br>**3,326** | 2,720<br>2,760<br>3,280<br>3,400<br>3,410<br>3,410<br>3,500<br>5,520<br>**3,500** | 3,924<br>3,596<br>**3,760** | 10,224<br>10,332<br>10,368<br>**10,308** |
| 560<br>560<br>640<br>1,060<br>**705** | 985<br>1,210<br>1,210<br>1,360<br>**1,191** | 1,224<br>1,416<br>1,704<br>1,952<br>2,000<br>**1,659** | 1,740<br>2,500<br>**2,120** | 2,321<br>3,034<br>**2,677** | 1,848<br>2,488<br>2,876<br>3,340<br>5,344<br>**3,179** | 2,230<br>2,590<br>3,190<br>3,290<br>3,520<br>3,700<br>4,040<br>4,360<br>**3,365** | 2,540<br>2,840<br>2,720<br>3,640<br>4,380<br>4,420<br>4,460<br>**3,571** | 3,400<br>3,440<br>3,600<br>3,920<br>3,940<br>4,400<br>4,900<br>5,460<br>**4,132** | 9,864<br>10,284<br>11,832<br>**10,660** |
| 720<br>800<br>1,100<br>1,100<br>**930** | 520<br>1,120<br>1,160<br>1,800<br>1,856<br>**1,291** | 1,668<br>1,722<br>**1,695** | 1,420<br>1,570<br>1,910<br>2,110<br>2,200<br>2,400<br>2,470<br>3,200<br>**2,160** | 2,640<br>2,824<br>**2,732** | | | | | |
| | | | | 944<br>2,136<br>2,552<br>3,864<br>4,480<br>**2,795** | | | | | |

In computing the profit and loss resulting from the various experiments the arbitrary value of $9 a ton has been used for hay, and the values given in the table below for the various fertilizer ingredients used in the tests. It was found impracticable to assign a value to some of the substances, but these are generally unimportant, and all tests in which these substances entered have been eliminated in making up averages.

*Valuation of fertilizer ingredients used in plat tests on soils.*

| Ingredient. | Cost per ton. | Ingredient. | Cost per ton. |
|---|---|---|---|
| | *Dollars.* | | *Dollars.* |
| Nitrate of soda | 50.00 | Cotton-seed meal | 25.00 |
| Sulphate of ammonia | 62.00 | Cotton-seed hull ashes | 34.00 |
| Acid phosphate | 14.00 | Muck | (a) |
| Rock phosphate | 9.00 | Seaweed | (a) |
| Nitrate of potash | 50.00 | Wheat bran | (a) |
| Sulphate of potash | 60.00 | Manure | .50 |
| Muriate of potash | 44.00 | Ammonium phosphate | (a) |
| Kainit | 12.00 | Iron alumina | (a) |
| Krugit | (a) | Caustic potash | (a) |
| Sulphate of iron | (a) | Magnesium oxide | (a) |
| Wood ashes | 5.00 | Barium oxide | (a) |
| Lime | 6.00 | Sulphuric acid | (a) |
| Gypsum | 8.00 | Shell marl | .50 |
| Salt | 8.00 | Soft-coal ashes | (a) |
| Floats | 8.00 | Ammonite | (a) |
| Basic slag | 12.50 | Fish scrap | 40.00 |
| Sulphate of potash-magnesia | (a) | Tobacco stems | 15.00 |
| Niterlime | (a) | Straw | (a) |
| Dried blood | 40.00 | Wool waste | (a) |
| Tankage | 26.00 | Coal ashes | (a) |
| Boneblack | 22.00 | Sulphate of magnesia | (a) |
| Ground bone | 26.00 | Commercial fertilizer | 20.00 |
| Cotton seed | 16.00 | | |

[a] Not valued.

The following table gives a complete summary of the results of the fertilizer tests:

*Results of fertilizer tests on hay soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Pounds.* | *Lbs.* | *Dolls.* | *Lbs.* | *Dolls.* | *Dolls.* |
| Nitrate of soda | 67 | 21.3 : 1 | − 212 to 4,140 | 199 | 4.97 | 1,484 | 6.67 | 1.70 |
| Sulphate of ammonia | 13 | 12.0 : 1 | − 40 to 3,718 | 240 | 7.45 | 1,367 | 6.15 | −1.30 |
| Ammonium phosphate | 1 | 1.0 : 0 | 3,985 | 400 | ...... | [a]3,985 | 17.93 | ........ |
| Acid phosphate | 82 | 3.5 : 1 | − 960 to 4,320 | 391 | 2.73 | 660 | 2.97 | .24 |
| Rock phosphate | 27 | 12.5 : 1 | − 65 to 3,745 | 897 | 4.04 | 1,010 | 4.55 | .51 |
| Basic slag | 12 | 3.0 : 1 | −1,625 to 3,550 | 823 | 5.14 | 1,026 | 4.62 | − .52 |
| Iron alumina phosphate | 3 | 3.0 : 0 | 725 to 2,738 | 370 | ...... | [a]1,754 | 7.89 | ........ |
| Nitrate of potash | 8 | 7.0 : 1 | − 244 to 4,145 | 267 | 6.68 | 1,833 | 8.25 | 1.57 |
| Sulphate of potash | 15 | 6.5 : 1 | − 192 to 2,054 | 201 | 6.03 | 779 | 3.50 | −2.53 |
| Muriate of potash | 38 | 0.9 : 1 | −1,761 to 2,400 | 191 | 4.20 | 84 | .38 | −3.82 |
| Kainit | 1 | 1.0 : 0 | 767 | 800 | 4.80 | 767 | 3.45 | −1.35 |
| Cotton-seed hull ashes | 1 | 1.0 : 0 | 864 | 200 | 3.40 | 864 | 3.89 | .49 |
| Caustic potash | 1 | 1.0 : 0 | 2,350 | 900 | ...... | [a]2,350 | 10.57 | ........ |
| Sulphate of magnesia | 2 | 2.0 : 0 | 283 to 320 | 75 | ...... | [a]301 | 1.35 | ........ |
| Magnesium oxide | 4 | 3.0 : 1 | 0 to 975 | 1,400 | ...... | [a]552 | 2.48 | ........ |
| Barium oxide | 4 | 3.0 : 1 | 0 to 715 | 1,400 | ...... | [a]390 | 1.75 | ........ |
| Krugit | 1 | 1.0 : 0 | 2,050 | 800 | ...... | [a]2,050 | 9.22 | ........ |
| Sulphuric acid | 2 | 1.0 : 1 | − 152 to 384 | 107 | ...... | [a]116 | .52 | ........ |
| Wood ashes | 7 | 7.0 : 0 | 490 to 2,285 | 971 | 2.43 | 1,343 | 6.04 | 3.61 |
| Lime | 102 | 1.7 : 1 | −1,410 to 2,080 | 2,692 | 8.08 | 285 | 1.28 | −6.80 |
| Shell marl | 4 | 4.0 : 0 | 650 to 1,560 | 13,000 | 3.25 | 1,089 | 4.90 | 1.65 |
| Gypsum | 68 | 0.9 : 1 | − 950 to 1,755 | 641 | 2.56 | 113 | .51 | −2.05 |
| Salt | 2 | 1.0 : 1 | − 549 to 920 | 220 | .88 | 185 | .83 | − .05 |
| Soft-coal ashes | 4 | 1.0 : 1 | − 455 to 390 | 13,000 | ...... | [a]16 | .07 | ........ |
| Total and averages | 469 | 2.6 : 1 | .................. | .......... | 4.84 | 655 | 2.94 | −1.90 |

[a] Not included in the averages, as the cost of fertilizers is not stated.

*Results of fertilizer tests on hay soils*—Continued.

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Pounds.* | *Lbs.* | *Dolls.* | *Lbs.* | *Dolls.* | *Dolls.* |
| Nitrate of soda<br>Acid phosphate | 11 | 11.0 : 0 | 496 to 2,455 | 148<br>331 | 6.02 | 1,344 | 6.05 | 0.03 |
| Nitrate of soda<br>Basic slag | 1 | 1.0 : 0 | 5,354 | 160<br>800 | 9.00 | 5,354 | 24.09 | 15.09 |
| Nitrate of soda<br>Sulphate of potash | 6 | 6.0 : 0 | 1,580 to 4,020 | 320<br>300 | 17.00 | 2,407 | 10.83 | − 6.17 |
| Nitrate of soda<br>Muriate of potash | 9 | 9.0 : 0 | 1,120 to 3,100 | 158<br>140 | 7.02 | 1,818 | 8.18 | 1.14 |
| Nitrate of soda<br>Lime | 2 | 2.0 : 0 | 705 to 2,172 | 160<br>2,000 | 10.00 | 1,438 | 6.47 | − 3.53 |
| Sulphate of ammonia<br>Acid phosphate | 1 | 0.0 : 1 | − 1,100 | 100<br>260 | 4.92 | −1,100 | −4.95 | − 9.87 |
| Sulphate of ammonia<br>Muriate of potash | 2 | 0.0 : 2 | − 600 to −68 | 170<br>190 | 9.45 | − 334 | −1.50 | −10.95 |
| Acid phosphate<br>Sulphate of potash | 9 | 9.0 : 0 | 306 to 3,869 | 313<br>219 | 8.77 | 1,878 | 8.45 | − .32 |
| Acid phosphate<br>Muriate of potash | 82 | 6.4 : 1 | −1,367 to 4,737 | 302<br>185 | 6.18 | 1,239 | 5.57 | − .61 |
| Acid phosphate<br>Lime | 2 | 1.0 : 1 | − 215 to 592 | 340<br>2,000 | 8.38 | 189 | .85 | − 7.53 |
| Rock phosphate<br>Kainit | 4 | 1.0 : 1 | − 56 to 66 | 2,000<br>600 | 12.60 | 4 | .02 | −12.58 |
| Basic slag<br>Acid phosphate | 1 | 1.0 : 0 | 566 | 300<br>300 | 3.98 | 566 | 2.55 | − 1.43 |
| Muriate of potash<br>Lime | 2 | 1.0 : 1 | − 18 to 1,025 | 160<br>2,000 | 9.52 | 503 | 2.26 | − 7.26 |
| Lime<br>Gypsum | 2 | 0.0 : 2 | − 488 to −295 | 2,000<br>400 | 7.60 | − 391 | −1.76 | − 9.36 |
| Gypsum<br>Ashes | 2 | 2.0 : 0 | 864 to 1,760 | 100<br>600 | 1.90 | 1,312 | 5.90 | 4.00 |
| Total and averages | 136 | .......... | .......... | .......... | 7.20 | 1,289 | 5.80 | − 1.40 |

MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre used. | Fertilizer per acre cost. | Average crop increase (Lbs.) | Average crop increase (Dolls.) | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 1,013 | 200<br>500<br>200 | 14.50 | 1,013 | 4.56 | − 9.94 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 96 | 11.0 : 1 | −1,020 to 4,913 | 318<br>317<br>178 | 14.07 | 1,676 | 7.54 | − 6.53 |
| Nitrate of soda<br>Basic slag<br>Muriate of potash | 2 | 2.0 : 0 | 2,595 to 2,893 | 266<br>330<br>178 | 12.63 | 2,744 | 12.35 | − .28 |
| Nitrate of soda<br>Acid phosphate<br>Lime | 2 | 2.0 : 0 | 1,425 to 2,212 | 160<br>320<br>2,000 | 12.24 | 1,818 | 8.18 | − 4.06 |
| Nitrate of soda<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 975 to 1,222 | 160<br>160<br>2,000 | 13.52 | 1,098 | 4.94 | − 8.58 |
| Niterlime<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 310 | 160<br>320<br>80 | ...... | [a] 310 | 1.39 | ........ |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 75 | 6.5 : 1 | −1,024 to 4,390 | 265<br>296<br>191 | 14.47 | 1,021 | 4.59 | − 9.88 |
| Sulphate of ammonia<br>Acid phosphate<br>Caustic potash | 2 | 2.0 : 0 | 690 to 1,112 | 700<br>350<br>900 | ...... | [a] 901 | 4.05 | ........ |

[a] Not included in the averages, as the cost of fertilizers is not stated.

*Results of fertilizer tests on hay soils*—Continued.

MIXTURES OF THREE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Pounds.* | *Lbs.* | *Dolls.* | *Lbs.* | *Dolls.* | *Dolls.* |
| Ammonite<br>Acid phosphate<br>Muriate of potash | 3 | 3.0 : 0 | 456 to 737 | 384<br>320<br>160 | ...... | *a* 588 | 2.65 | ......... |
| Acid phosphate<br>Muriate of potash<br>Lime | 2 | 1.0 : 1 | − 48 to 2,705 | 320<br>160<br>2,000 | 11.76 | 1,328 | 5.98 | − 5.78 |
| Wood ashes<br>Gypsum<br>Salt | 1 | 1.0 : 0 | 1,595 | 64<br>80<br>56 | .70 | 1,595 | 7.17 | 6.47 |
| Nitrate of soda<br>Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 4 | 4.0 : 0 | 910 to 3,972 | 240<br>150<br>200<br>150 | 16.55 | 1,805 | 8.12 | − 8.43 |
| Nitrate of potash<br>Basic slag<br>Sulphate of potash<br>Lime | 3 | 3.0 : 0 | 1,907 to 5,718 | 160<br>600<br>300<br>2,000 | 22.75 | 3,994 | 17.97 | − 4.78 |
| Nitrate of soda<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 304 | 66<br>16<br>500<br>100 | 7.85 | 304 | 1.37 | − 6.48 |
| Nitrate of soda<br>Sulphate of ammonia<br>Rock phosphate<br>Muriate of potash | 1 | 0.0 : 1 | − 601 | 66<br>16<br>1,000<br>100 | 7.85 | − 601 | −2.70 | −10.55 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 1,862 to 3,505 | 160<br>320<br>160<br>2,000 | 15.76 | 2,683 | 12.07 | − 3.69 |
| Total and averages | 198 | ......... | .................. | ......... | 14.20 | 1,449 | −6.52 | −20.72 |

ORGANIC FERTILIZERS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Pounds.* | *Lbs.* | *Dolls.* | *Lbs.* | *Dolls.* | *Dolls.* |
| Dried blood | 23 | 0.6 : 1 | −1,950 to 950 | 222 | 4.43 | −208 | −0.94 | − 5.37 |
| Tankage | 3 | 3.0 : 0 | 353 to 1,204 | 467 | 6.07 | 717 | 3.22 | − 2.85 |
| Boneblack | 5 | 1.5 : 1 | − 75 to 1,600 | 415 | 4.56 | 679 | 3.06 | − 1.50 |
| Ground bone | 28 | 3.0 : 1 | −1,167 to 3,740 | 621 | 8.07 | 698 | 3.14 | − 4.93 |
| Fish scrap | 1 | 1.0 : 0 | 410 | 200 | 4.00 | 410 | 1.85 | − 2.15 |
| Cotton-seed meal | 4 | 3.0 : 1 | − 121 to 1,355 | 425 | 5.31 | 615 | 2.77 | − 2.54 |
| Tobacco stems | 2 | 2.0 : 0 | 730 to 1,850 | 4,000 | 30.00 | 1,290 | 5.80 | −24.20 |
| Wheat bran | 2 | 2.0 : 0 | 85 to 1,825 | 250 | ....... | *a* 955 | 4.30 | ......... |
| Straw | 1 | 0.0 : 1 | 0 | ......... | ....... | *a* 0 | 0 | ......... |
| Muck | 4 | 0.3 : 1 | − 948 to 716 | 12,000 | ....... | *a* −130 | .59 | ......... |
| Total and averages | 73 | 1.7 : 1 | .................. | ......... | 6.88 | 385 | 1.73 | − 5.15 |

ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Pounds.* | *Lbs.* | *Dolls.* | *Lbs.* | *Dolls.* | *Dolls.* |
| Dried blood<br>Acid phosphate | 24 | 5.0 : 1 | −400 to 2,789 | 220<br>292 | 6.45 | 854 | 3.84 | − 2.61 |
| Dried blood<br>Muriate of potash | 21 | 0.9 : 1 | −780 to 798 | 218<br>200 | 8.76 | 86 | .39 | − 8.37 |
| Boneblack<br>Muriate of potash | 1 | 1.0 : 0 | 1,160 | 72<br>102 | 3.03 | 1,160 | 5.22 | 2.19 |
| Boneblack<br>Kainit | 4 | 4.0 : 0 | 522 to 822 | 1,000<br>600 | 14.60 | 645 | 2.90 | −11.70 |
| Ground bone<br>Nitrate of soda | 1 | 1.0 : 0 | 1,500 | 200<br>100 | 5.10 | 1,500 | 6.75 | 1.65 |
| Ground bone<br>Acid phosphate | 1 | 1.0 : 0 | 778 | 300<br>300 | 6.00 | 778 | 3.50 | − 2.50 |

[a] Not included in the averages, as the cost of fertilizers is not stated.

*Results of fertilizer tests on hay soils*—Continued.

ORGANIC FERTILIZERS WITH ONE MINERAL—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Pounds.* | *Lbs.* | *Dolls.* | *Lbs.* | *Dolls.* | *Dolls.* |
| Wool waste<br>Caustic potash | 1 | 1.0 : 0 | 1,754 | 2,000<br>900 | ...... | [a]1,754 | 7.89 | ........ |
| Wool waste<br>Coal ashes | 2 | 2.0 : 0 | 415 to 1,570 | 2,000<br>........ | ...... | [a] 992 | 4.46 | ........ |
| Total and averages | 55 | 2.7 : 1 | ................ | ........ | 7.91 | 545 | 2.45 | − 5.46 |
| ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS. | | | | | | | | |
| Dried blood<br>Acid phosphate<br>Muriate of potash | 94 | 8.4 : 1 | − 740 to 3,413 | 437<br>298<br>200 | 15.23 | 1,396 | 6.28 | − 8.95 |
| Dried blood<br>Ground bone<br>Muriate of potash | 16 | 15.0 : 1 | − 200 to 4,857 | 217<br>195<br>199 | 11.25 | 1,490 | 6.70 | − 4.55 |
| Tankage<br>Acid phosphate<br>Sulphate of potash | 4 | 0.3 : 1 | − 520 to 65 | 100<br>200<br>80 | 5.10 | −325 | −1.46 | − 6.56 |
| Boneblack<br>Nitrate of soda<br>Kainit | 4 | 4.0 : 0 | 794 to 1,300 | 1,000<br>100<br>600 | 17.10 | 1,052 | 4.73 | −12.37 |
| Boneblack<br>Sulphate of ammonia<br>Muriate of potash | 3 | 3.0 : 0 | 420 to 1,180 | 72<br>288<br>102 | 11.96 | 893 | 4.02 | − 7.94 |
| Ground bone<br>Sulphate of ammonia<br>Muriate of potash | 13 | 13.0 : 0 | 70 to 3,229 | 252<br>260<br>200 | 15.75 | 1,651 | 7.43 | − 8.32 |
| Ground bone<br>Kainit<br>Lime | 4 | 3.0 : 1 | − 88 to 272 | 1,000<br>600<br>2,000 | 22.60 | 115 | .52 | −22.08 |
| Ground bone<br>Wood ashes<br>Gypsum | 2 | 2.0 : 0 | 320 to 960 | 100<br>24<br>100 | 1.76 | 640 | 2.88 | 1.12 |
| Wool waste<br>Acid phosphate<br>Caustic potash | 4 | 4.0 : 0 | 736 to 3,036 | 2,000<br>350<br>900 | ...... | [a]1,835 | 8.26 | ........ |
| Wool waste<br>Acid phosphate<br>Coal ashes | 2 | 2.0 : 0 | 1,286 to 2,120 | 2,000<br>350 | ...... | [a]1,703 | 7.66 | ........ |
| Wool waste<br>Caustic potash<br>Coal ashes | 3 | 3.0 : 0 | 690 to 1,937 | 2,000<br>900 | ...... | [a]1,182 | 5.32 | ........ |
| Boneblack<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 1 | 0.0 : 1 | − 600 | 30<br>80<br>340<br>15 | 5.52 | −600 | −2.70 | − 8.22 |
| Total and averages | 150 | 8.4 : 1 | ................ | ........ | 14.47 | 1,300 | 5.85 | − 8.62 |
| MANURE AND COMBINATIONS. | | | | | | | | |
| Manure | 95 | 6.7 : 1 | −1,040 to 4,420 | 23,561 | 5.89 | 1,392 | 6.26 | 0.37 |
| Manure<br>Lime | 23 | 4.7 : 1 | − 774 to 4,053 | 49,913<br>3,304 | 22.39 | 1,298 | 5.84 | −16.55 |
| Manure<br>Rock phosphate<br>Kainit | 3 | 3.0 : 0 | 1,760 to 2,152 | 120,000<br>2,000<br>6,000 | 42.60 | 1,918 | 8.63 | −33.97 |
| Total and averages | 121 | ........ | ................ | ........ | 9.94 | 1,387 | 6.24 | − 3.70 |
| COMMERCIAL FERTILIZERS. | | | | | | | | |
| Commercial fertilizers | 61 | 2.0 : 1 | −998 to 2,400 | 326 | 3.26 | 354 | 1.59 | −1.67 |

[a] Not included in the averages, as the cost of fertilizers is not stated.

The following table gives the actual number of cases of increase, of no increase, ratio, and average yield:

*Actual number of increases and no increases with each class of fertilizers, together with the ratio and the average increase of crop.*

| Fertilizer. | Number of experiments. | Increases. | No increases. | Increase to no increase. | Average increase per acre. |
|---|---|---|---|---|---|
| | | | | *Ratio.* | |
| Minerals alone | 469 | 340 | 129 | 2.6 : 1 | 655 |
| Minerals in combinations of two | 136 | 116 | 20 | 5.8 : 1 | 1,289 |
| Minerals in combinations of three or more | 198 | 178 | 20 | 8.9 : 1 | 1,449 |
| Organic fertilizers alone | 73 | 46 | 27 | 1.7 : 1 | 385 |
| Organic fertilizers in combination with one mineral | 55 | 40 | 15 | 2.7 : 1 | 545 |
| Organic fertilizers in combination with two or more minerals | 150 | 134 | 16 | 8.4 : 1 | 1,300 |
| Manure alone, and in combinations | 121 | 105 | 16 | 6.6 : 1 | 1,387 |
| Commercial fertilizers | 61 | 41 | 20 | 2.0 : 1 | 354 |
| Total | 1,263 | 1,000 | 263 | 3.8 : 1 | 965 |

The following table gives all the available data bearing on the effectiveness of the use of single substances and combinations of these substances. It gives the sum of the increases due to individual constituents and the increase due to applications of mixtures of these substances.

*Increase in yield per acre of hay due to single fertilizers, compared with increase due to mixtures of these fertilizers.*

| Fertilizer. | Number of experiments. | Increase per acre. |
|---|---|---|
| Nitrate of soda | 67 | 1,484 |
| Acid phosphate | 82 | 660 |
| Total of two | .......... | 2,144 |
| Mixture | 11 | 1,344 |
| Acid phosphate | 82 | 660 |
| Muriate of potash | 38 | 84 |
| Total of two | .......... | 744 |
| Mixture | 82 | 1,239 |
| Nitrate of soda | 67 | 1,484 |
| Acid phosphate | 82 | 660 |
| Muriate of potash | 38 | 84 |
| Total of three | .......... | 2,228 |
| Mixture | 96 | 1,676 |
| Sulphate of ammonia | 13 | 1,367 |
| Acid phosphate | 82 | 660 |
| Muriate of potash | 38 | 84 |
| Total of three | .......... | 2,111 |
| Mixture | 75 | 1,021 |
| Dried blood | 23 | −208 |
| Acid phosphate | 82 | 660 |
| Total of two | .......... | 452 |
| Mixture | 24 | 855 |

| Fertilizer. | Number of experiments. | Increase per acre. |
|---|---|---|
| Dried blood | 23 | −208 |
| Muriate of potash | 38 | 84 |
| Total of two | .......... | −124 |
| Mixture | 21 | 86 |
| Dried blood | 23 | −208 |
| Acid phosphate | 82 | 660 |
| Muriate of potash | 38 | 84 |
| Total of three | .......... | 536 |
| Mixture | 94 | 1,396 |
| Dried blood | 23 | −208 |
| Ground bone | 28 | 698 |
| Muriate of potash | 38 | 84 |
| Total of three | .......... | 574 |
| Mixture | 16 | 1,490 |
| Ground bone | 28 | 698 |
| Sulphate of ammonia | 13 | 1,369 |
| Muriate of potash | 38 | 84 |
| Total of three | .......... | 2,149 |
| Mixture | 13 | 1,651 |

The following table gives all the data available bearing on the effect of increasing the amount of fertilizers applied to the soil:

*Increase in yield of hay attributable to different amounts of fertilizers.*

| Fertilizer. | Quantity per acre. | Number of experiments. | Range of effects as shown in yields. | Average change in yield per acre. |
|---|---|---|---|---|
| | *Pounds.* | | *Pounds.* | *Pounds.* |
| Nitrate of soda | Below 100 | 6 | 160 to 3,485 | 1,597 |
| | 100 to 149 | 11 | — 212 to 2,465 | 1,092 |
| | 150 to 199 | 23 | — 100 to 2,760 | 975 |
| | 200 to 249 | 11 | 33 to 3,020 | 1,767 |
| | 250 to 299 | 2 | 1,587 to 2,925 | 2,256 |
| | 300 to 349 | 9 | 1,585 to 4,140 | 2,460 |
| | 350 to 399 | ........ | ........ | ........ |
| | 400+ | 5 | 346 to 3,948 | 1,835 |
| Acid phosphate | Below 200 | 2 | 832 to 1,056 | 944 |
| | 200 to 249 | ........ | ........ | ........ |
| | 250 to 299 | 8 | — 483 to 1,821 | 613 |
| | 300 to 349 | 35 | — 960 to 3,290 | 653 |
| | 350 to 399 | 9 | — 600 to 2,300 | 586 |
| | 400 to 499 | 15 | — 525 to 4,320 | 938 |
| | 500 to 599 | 6 | — 350 to 873 | 249 |
| | 600+ | 7 | 125 to 1,400 | 719 |
| Rock phosphate | Below 500 | 2 | 825 to 3,745 | 2,285 |
| | 500 to 549 | 9 | 138 to 2,550 | 1,015 |
| | 550 to 599 | 9 | — 50 to 2,230 | 941 |
| | 600+ | 7 | — 65 to 1,560 | 701 |
| Muriate of potash | Below 100 | 2 | 1,030 to 2,005 | 1,517 |
| | 100 to 149 | 1 | —648 | —648 |
| | 150 to 199 | 13 | — 520 to 2,400 | 363 |
| | 200 to 249 | 21 | —5,471 to 883 | —154 |
| | 250+ | 2 | —1,761 to 1,100 | —330 |
| Lime | Below 500 | 10 | — 880 to 1,920 | 68 |
| | 500 to 999 | 7 | — 41 to 2,080 | 674 |
| | 1,000 to 1,499 | 16 | — 325 to 1,300 | 391 |
| | 1,500 to 1,999 | 4 | 473 to 1,355 | 826 |
| | 2,000 to 2,999 | 15 | — 144 to 1,234 | 463 |
| | 3,000 to 3,999 | 5 | 80 to 1,440 | 903 |
| | 4,000+ | 45 | —1,410 to 1,667 | 123 |
| Gypsum | Below 200 | 5 | — 389 to 1,755 | 633 |
| | 200 to 299 | 4 | — 320 to 1,360 | 679 |
| | 300 to 399 | 33 | — 950 to 1,000 | 39 |
| | 400 to 499 | 12 | — 392 to 488 | — 68 |
| | 500 to 999 | 9 | — 730 to 1,332 | — 7 |
| | 1.000+ | 5 | — 130 to 650 | 238 |
| Ground bone | Below 300 | 1 | —96 | — 96 |
| | 300 to 399 | 5 | 220 to 3,740 | 1,453 |
| | 400 to 499 | 7 | — 540 to 1,350 | 300 |
| | 500 to 599 | 2 | —1,167 to 735 | —216 |
| | 600+ | 13 | — 400 to 2,750 | 824 |
| Manure | Below 10,000 | 2 | 1,200 to 1,288 | 1,244 |
| | 10,000 to 15,999 | 26 | — 760 to 3,804 | 946 |
| | 16,000 to 19,999 | 24 | — 844 to 3,637 | 1,364 |
| | 20.000 to 39,999 | 31 | —1,040 to 5,612 | 1,518 |
| | 40,000+ | 12 | 120 to 4,055 | 2,175 |
| Commercial fertilizers | 200 to 249 | 7 | 464 to 2,400 | 1,152 |
| | 250 to 299 | 14 | — 998 to 2,247 | 336 |
| | 300 to 349 | 14 | — 496 to 960 | 53 |
| | 350 to 399 | 2 | — 208 to 800 | 296 |
| | 400 to 499 | 19 | — 950 to 912 | 276 |
| | 500+ | 5 | — 36 to 1,339 | 451 |

The following table gives all the data available showing the effect of fertilizers when applied to soils of different productivity, as measured by the yield of check plats:

*Increase in yield of hay attributable to fertilizers, arranged in accordance with the actual yield of the check plats.*

| Fertilizer. | Yield of unfertilized plats. | Number of experiments. | Range of effects as shown in yields. | Average change in yield per acre. |
|---|---|---|---|---|
| | *Pounds.* | | *Pounds.* | *Pounds.* |
| Nitrate of soda | Below 500 | 3 | 13 to 1,075 | 531 |
| | 500 to 999 | 3 | 762 to 1,530 | 1,182 |
| | 1,000 to 1,999 | 13 | 0 to 3,485 | 1,698 |
| | 2,000 to 2,999 | 28 | 250 to 3,440 | 1,345 |
| | 3,000 to 3,999 | 7 | −100 to 3,020 | 1,961 |
| | 4,000 to 4,999 | 1 | 346 | 346 |
| | 5,000+ | 10 | 539 to 3,948 | 2,030 |
| Acid phosphate | Below 1,000 | 6 | 18 to 505 | 246 |
| | 1,000 to 1,999 | 15 | −624 to 2,300 | 683 |
| | 2,000 to 2,999 | 17 | −483 to 2,288 | 559 |
| | 3,000 to 3,999 | 16 | −376 to 1,821 | 584 |
| | 4,000 to 4,999 | 10 | 125 to 1,970 | 646 |
| | 5,000 to 5,999 | 4 | −960 to 831 | 118 |
| | 6,000 to 6,999 | 6 | 750 to 4,320 | 2,056 |
| | 7,000+ | 8 | −900 to 2,220 | 886 |
| Rock phosphate | Below 1,000 | 3 | 715 to 1,560 | 1,172 |
| | 1,000 to 1,999 | 9 | −65 to 2,550 | 1,291 |
| | 2,000 to 2,999 | | | |
| | 3,000 to 3,999 | 9 | 138 to 1,238 | 653 |
| | 4,000 to 4,999 | 4 | −50 to 675 | 375 |
| | 5,000+ | 2 | 825 to 3,745 | 2,285 |
| Muriate of potash | Below 1,000 | 5 | −105 to 612 | 218 |
| | 1,000 to 1,999 | 9 | −600 to 2,400 | 192 |
| | 2,000 to 2,999 | 10 | −400 to 1,030 | 357 |
| | 3,000 to 3,999 | 10 | −795 to 2,005 | 244 |
| | 4,000 to 4,999 | 1 | −510 | −510 |
| | 5,000+ | 2 | −1,761 to −300 | −1,030 |
| Lime | Below 1,000 | 21 | −770 to 1,040 | 280 |
| | 1,000 to 1,499 | 29 | −664 to 1,490 | 521 |
| | 1,500 to 1,999 | 15 | −819 to 1,920 | 558 |
| | 2,000 to 2,499 | 3 | 1,043 to 1,667 | 1,283 |
| | 2,500 to 2,999 | 10 | −1,032 to 1,333 | −212 |
| | 3,000 to 3,499 | 7 | −1,120 to 1,600 | 68 |
| | 3,500 to 3,999 | 8 | −816 to 2,080 | 369 |
| | 4,000 to 4,999 | 2 | −1,410 to 350 | −530 |
| | 5,000+ | 8 | −960 to 47 | −453 |
| Gypsum | Below 1,000 | 7 | −578 to 430 | −34 |
| | 1,000 to 1,999 | 18 | −800 to 1,360 | 201 |
| | 2,000 to 2,999 | 11 | −476 to 535 | −60 |
| | 3,000 to 3,999 | 14 | −950 to 1,000 | 74 |
| | 4,000 to 4,999 | 4 | −730 to 488 | −101 |
| | 5,000+ | 14 | −600 to 1,755 | 193 |
| Acid phosphate and muriate of potash | Below 1,000 | 7 | 46 to 2,712 | 1,319 |
| | 1,000 to 1,999 | 23 | −400 to 3,669 | 1,043 |
| | 2,000 to 2,999 | 17 | −640 to 4,245 | 1,475 |
| | 3,000 to 3,999 | 27 | −240 to 3,130 | 1,441 |
| | 4,000 to 4,999 | 4 | 1,530 to 2,610 | 2,140 |
| | 5,000+ | 2 | −1,367 to −836 | −1,101 |
| Nitrate of soda, acid phosphate, and muriate of potash | Below 1,000 | 7 | 550 to 3,712 | 1,561 |
| | 1,000 to 1,999 | 24 | −200 to 4,600 | 1,556 |
| | 2,000 to 2,999 | 31 | 64 to 4,913 | 1,965 |
| | 3,000 to 3,999 | 27 | −804 to 4,575 | 1,743 |
| | 4,000 to 4,999 | 3 | 1,430 to 2,330 | 1,803 |
| | 5,000+ | 4 | −1,020 to 175 | −376 |
| Sulphate of ammonia, acid phosphate, and muriate of potash | Below 1,000 | 3 | −114 to 214 | 22 |
| | 1,000 to 1,499 | 15 | 400 to 1,709 | 647 |
| | 1,500 to 1,999 | 6 | 53 to 2,520 | 1,174 |
| | 2,000 to 2,499 | 8 | 20 to 3,686 | 2,046 |
| | 2,500 to 2,999 | 18 | −736 to 2,997 | 763 |
| | 3,000 to 3,499 | 11 | −160 to 2,000 | 1,104 |
| | 3,500 to 3,999 | 8 | −1,024 to 4,390 | 1,202 |
| | 4,000+ | 6 | 560 to 2,510 | 1,380 |

*Increase in yield of hay attributable to fertilizers, etc.*—Continued.

| Fertilizer. | Yield of unfertilized plats. | Number of experiments. | Range of effects as shown in yields. | Average change in yield per acre. |
|---|---|---|---|---|
| | *Pounds.* | | *Pounds.* | *Pounds.* |
| Dried blood | Below 1,000 | 2 | 122 to 950 | 536 |
| | 1,000 to 1,999 | 5 | −424 to 202 | −241 |
| | 2,000 to 2,999 | 6 | −800 to 307 | −394 |
| | 3,000 to 3,999 | 7 | −1,927 to 416 | −413 |
| | 4,000+ | 2 | −1,950 to 160 | −895 |
| Ground bone | 1,000 to 1,999 | 3 | 1,400 to 2,750 | 1,917 |
| | 2,000 to 2,999 | 10 | −1,167 to 1,740 | 360 |
| | 3,000 to 3,999 | 8 | −400 to 3,740 | 1,104 |
| | 4,000+ | 7 | −280 to 425 | 178 |
| Dried blood and acid phosphate | Below 1,000 | 1 | 1,130 | 1,130 |
| | 1,000 to 1,999 | 7 | −400 to 2,789 | 767 |
| | 2,000 to 2,999 | 6 | −51 to 1,627 | 583 |
| | 3,000 to 3,999 | 8 | −256 to 1,917 | 995 |
| | 4,000+ | 2 | 40 to 2,490 | 1,265 |
| Dried blood and muriate of potash | Below 1,000 | 1 | 798 | 798 |
| | 1,000 to 1,999 | 5 | −224 to 522 | 79 |
| | 2,000 to 2,999 | 6 | −780 to 712 | 139 |
| | 3,000 to 3,999 | 7 | −600 to 376 | −17 |
| | 4,000+ | 2 | −4 to 490 | 243 |
| Dried blood, acid phosphate, and muriate of potash | Below 1,000 | 5 | 910 to 2,430 | 1,665 |
| | 1,000 to 1,499 | 20 | −24 to 2,382 | 1,093 |
| | 1,500 to 1,999 | 5 | 245 to 677 | 387 |
| | 2,000 to 2,499 | 4 | 1,915 to 2,335 | 2,141 |
| | 2,500 to 2,999 | 18 | 160 to 3,413 | 1,607 |
| | 3,000 to 3,499 | 24 | 200 to 2,578 | 1,383 |
| | 3,500 to 3,999 | 9 | −584 to 3,170 | 1,534 |
| | 4,000 to 4,999 | 6 | 710 to 2,490 | 1,543 |
| | 5,000+ | 3 | −740 to −290 | −543 |
| Dried blood, ground bone, and muriate of potash | Below 1,000 | 2 | 70 to 1,830 | 950 |
| | 1,000 to 1,999 | 8 | −200 to 3,229 | 1,325 |
| | 2,000 to 2,499 | 0 | .............. | .......... |
| | 2,500 to 2,999 | 6 | 434 to 4,857 | 2,054 |
| | 3,000 to 3,499 | 6 | 400 to 2,741 | 1,786 |
| | 3,500 to 3,999 | 3 | 106 to 3,590 | 1,835 |
| | 4,000 to 4,999 | 2 | 1,706 to 2,170 | 1,938 |
| | 5,000+ | 1 | 240 | 240 |
| Manure | Below 1,000 | 9 | 810 to 5,612 | 2,484 |
| | 1,000 to 1,499 | 21 | −200 to 4,420 | 1,541 |
| | 1,500 to 1,999 | 7 | 293 to 2,205 | 1,460 |
| | 2,000 to 2,499 | 10 | −64 to 3,360 | 1,629 |
| | 2,500 to 2,999 | 18 | −250 to 4,373 | 1,195 |
| | 3,000 to 3,499 | 18 | −200 to 4,055 | 1,404 |
| | 3,500 to 3,999 | 7 | −844 to 2,170 | 510 |
| | 4,000 to 4,999 | 4 | −330 to 1,210 | 227 |
| | 5,000+ | 5 | −1,040 to 3,804 | 352 |
| Manure and lime | Below 1,000 | 8 | 1,238 to 2,383 | 1,995 |
| | 1,000 to 1,999 | 3 | −400 to 638 | −35 |
| | 2,000 to 2,999 | 6 | 448 to 4,053 | 1,487 |
| | 3,000 to 3,999 | 4 | −774 to 2,421 | 1,134 |
| | 4,000+ | 2 | −560 to 1,110 | 275 |
| Commercial fertilizers | 1,000 to 1,999 | 7 | 464 to 2,400 | 2,581 |
| | 2,000 to 2,999 | 35 | −400 to 1,339 | 228 |
| | 3,000 to 3,999 | 7 | −950 to 820 | −51 |
| | 4,000 to 4,999 | 8 | −998 to 824 | 213 |
| | 5,000+ | 4 | 368 to 2,247 | 1,055 |

The results for hay soils follow in general those for oat soils, but the tests are too few in number to enable the drawing of conclusions as definite as was possible in case of the latter crop.

## RESULTS OF TESTS OF FERTILIZERS ON SOILS USED FOR MISCELLANEOUS FARM CROPS.

There have been reported in this or in previous bulletins the results of 2,803 tests of fertilizers on soil for cotton, 6,394 tests on soils for corn, 3,227 tests on soils for wheat, 1,769 tests on soils for potatoes, 1,476 tests on soils for oats, and 1,263 tests on soils for hay—in all 16,932. In addition there have been recorded in the Station literature the results of some 3,589 tests of substances applied to soils for miscellaneous farm and truck crops. With none of these miscellaneous crops have there been sufficient tests made to enable a treatment similar to that adopted for the six crops named. The average results obtained with each fertilizer will therefore be given without attempting any further analysis of the figures.

### RYE.

New Jersey reports 21 tests, Rhode Island 20, Massachusetts 7, and Delaware 7 tests on soils for rye, with the following results:

*Results of fertilizer tests on rye soils.*

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| MINERALS SINGLY. | | | | | | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dollars.* |
| Nitrate of soda | 6 | 2.0 : 1 | −2.1 to 4.8 | 133 | 3.33 | 1.2 | 0.89 | −2.44 |
| Acid phosphate | 3 | 3.0 : 0 | 4.6 to 10.3 | 333 | 2.33 | 7.7 | 5.70 | 3.37 |
| Basic slag | 3 | 3.0 : 0 | .3 to 2.2 | 500 | 3.10 | 1.2 | .89 | −2.21 |
| Sulphate of potash | 2 | 1.0 : 1 | − .7 to 3.4 | 180 | 5.40 | 1.3 | .96 | −4.44 |
| Muriate of potash | 4 | 0.3 : 1 | −2.4 to 5.6 | 142 | 3.12 | .4 | .30 | −2.82 |
| Gypsum | 2 | 2.0 : 0 | 2.8 to 3.2 | 400 | 1.60 | 3.0 | 2.22 | .62 |
| Total and averages | 20 | .......... | ................ | ........ | 3.14 | 2.2 | 1.63 | −1.51 |
| MIXTURES OF TWO MINERALS. | | | | | | | | |
| Nitrate of soda<br>Acid phosphate | 2 | 2.0 : 0 | 10.1 to 18.9 | 150<br>350 | 6.20 | 14.5 | 10.73 | 4.53 |
| Nitrate of soda<br>Muriate of potash | 5 | 1.5 : 1 | −1.1 to 3.7 | 156<br>126 | 6.67 | 1.0 | .74 | −5.93 |
| Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 7.8 to 13.2 | 350<br>150 | 4.75 | 10.5 | 7.77 | 2.02 |
| Total and averages | 9 | .......... | ................ | ........ | 6.36 | 6.1 | 4.51 | −1.85 |
| MIXTURES OF THREE MINERALS. | | | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 3 | 3.0 : 0 | 6.6 to 16.6 | 177<br>367<br>167 | 10.67 | 12.6 | 9.32 | − 1.35 |
| Nitrate of soda<br>Sulphate of potash<br>Muriate of potash | 1 | 0.0 : 1 | −0.7 | 160<br>100<br>110 | 9.42 | −.7 | −.51 | − 9.93 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash-magnesia | 1 | 1.0 : 0 | 3.7 | 232<br>400<br>388 | ...... | [a] 3.7 | 2.74 | .......... |

[a] Not included in averages, as cost of fertilizers is not stated.

*Results of fertilizer tests on rye soils*—Continued.

MIXTURES OF THREE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dollars.* |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash-magnesia | 1 | 1.0 : 0 | 4.3 | 180<br>400<br>388 | ...... | [a]4.3 | 3.18 | ......... |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 1 | 0.0 : 1 | −0.9 | 180<br>400<br>200 | 12.78 | −.9 | −.67 | −13.45 |
| Total and averages | 7 | ......... | ......... | ......... | 10.84 | 7.2 | 5.33 | − 5.51 |

ORGANIC FERTILIZERS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Bush. | Dolls. | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| Boneblack | 1 | 1.0 : 0 | 2.2 | 180 | 1.98 | 2.2 | 1.63 | −0.35 |
| Ground bone | 3 | 3.0 : 0 | 1.3 to 11.9 | 367 | 4.77 | 7.9 | 5.85 | 1.08 |
| Seaweed | 1 | 1.0 : 0 | 21.2 | 10 | ...... | [a]21.2 | 15.63 | ......... |
| Total and averages | 5 | ......... | ......... | ......... | 4.07 | 6.5 | 4.81 | 3.74 |

ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Bush. | Dolls. | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| Ground bone<br>Acid phosphate | 1 | 1.0 : 0 | 3.2 | 300<br>300 | 6.00 | 3.2 | 2.37 | −3.63 |
| Ground bone<br>Muriate of potash | 1 | 1.0 : 0 | 11.0 | 400<br>110 | 7.62 | 11.0 | 8.14 | .52 |
| Ground bone<br>Boneblack | 1 | 1.0 : 0 | 7.6 | 480<br>180 | 8.22 | 7.6 | 5.62 | −2.60 |
| Ground bone<br>Sulphate of potash | 1 | 1.0 : 0 | 6.8 | 400<br>200 | 11.20 | 6.8 | 5.03 | −6.17 |
| Total and averages | 4 | ......... | ......... | ......... | 8.26 | 7.1 | 5.25 | −3.01 |

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Bush. | Dolls. | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 3.2 | 344<br>400<br>200 | 14.08 | 3.2 | 2.37 | −11.71 |
| Dried blood<br>Acid phosphate<br>Sulphate of potash-magnesia | 1 | 1.0 : 0 | 2.5 | 344<br>400<br>388 | ...... | [a]2.5 | 1.85 | ......... |
| Total and averages | 2 | ......... | ......... | ......... | 14.08 | 3.2 | 2.37 | −11.71 |

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Bush. | Dolls. | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| Manure | 4 | 4.0 : 0 | 3.4 to 22.6 | 37,064 | 9.27 | 14.0 | 10.36 | 1.09 |
| Manure<br>Ground bone | 1 | 1.0 : 0 | 21.2 | 34,128<br>400 | 13.73 | 21.2 | 15.68 | 1.95 |
| Manure<br>Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 23.4 | 34,128<br>160<br>110 | 14.95 | 23.4 | 17.32 | 2.37 |
| Manure<br>Acid phosphate<br>Sulphate of potash-magnesia | 1 | 1.0 : 0 | 4.9 | 6,400<br>144<br>256 | ...... | [a]4.9 | 3.63 | ......... |
| Total and averages | 7 | ......... | ......... | ......... | 10.96 | 17.6 | 13.02 | 2.06 |

COMMERCIAL FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Bush. | Dolls. | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| Commercial fertilizers | 1 | 1.0 : 0 | 14.1 | 500 | 15.00 | 14.1 | 10.43 | 5.43 |

[a] Not included in averages, as cost of fertilizers is not stated.

## BUCKWHEAT.

There have been reported 27 tests on soils for buckwheat, 17 from West Virginia and 10 from New Jersey, the results of which are given in the following table:

*Results of fertilizer tests with buckwheat soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. | | Average crop increase or decrease per acre. | | Average gain or loss per acre. |
|---|---|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | | | |
| | | *Ratio.* | *Bushels.* | *Lbs.* | *Dolls.* | *Bush.* | *Dolls.* | *Dollars.* |
| Nitrate of soda | 3 | 3.0 : 0 | 0.6 to 1.8 | 283 | 7.07 | 1.0 | 0.76 | − 6.31 |
| Acid phosphate | 7 | 7.0 : 0 | 3.4 to 18.1 | 314 | 2.20 | 13.9 | 10.56 | 8.36 |
| Sulphate of potash | 2 | 1.0 : 1 | −.8 to 1.1 | 400 | 12.00 | .1 | .08 | −11.92 |
| Muriate of potash | 1 | 1.0 : 0 | .8 | 150 | 3.30 | .8 | .61 | − 2.69 |
| Gypsum | 1 | 1.0 : 0 | 2.7 | 400 | 1.60 | 2.7 | 2.05 | .45 |
| Total and averages | 14 | | | | 4.68 | 7.4 | 5.62 | − .94 |
| MIXTURES OF TWO MINERALS. | | | | | | | | |
| Nitrate of soda<br>Acid phosphate | 3 | 3.0 : 0 | 6.3 to 19.9 | 183<br>233 | 6.21 | 14.1 | 10.72 | 4.51 |
| Nitrate of soda<br>Sulphate of potash | 1 | 1.0 : 0 | 1.1 | 200<br>200 | 11.00 | 1.1 | .84 | −10.16 |
| Nitrate of soda<br>Muriate of potash | 1 | 0.0 : 1 | −1.0 | 150<br>150 | 7.05 | −1.0 | − .76 | − 7.81 |
| Acid phosphate<br>Sulphate of potash | 2 | 2.0 : 0 | 6.1 to 16.7 | 200<br>200 | 7.40 | 11.4 | 8.66 | 1.26 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 21.9 | 350<br>150 | 5.75 | 21.9 | 16.64 | 10.89 |
| Total and averages | 8 | | | | 7.16 | 10.9 | 8.28 | 1.12 |
| MIXTURES OF THREE MINERALS. | | | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 2 | 2.0 : 0 | 3.4 to 17.5 | 166<br>166<br>116 | 8.82 | 10.5 | 7.98 | −64 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 21.3 | 150<br>350<br>150 | 9.50 | 21.3 | 16.19 | 6.69 |
| Total and averages | 3 | | | | 9.05 | 14.1 | 10.72 | 1.67 |
| MANURE AND COMBINATIONS. | | | | | | | | |
| Manure | 1 | 1.0 : 0 | 15.9 | 40,000 | 10.00 | 15.9 | 12.08 | 2.08 |
| Manure<br>Lime | 1 | 1.0 : 0 | 13.1 | 2,000<br>300 | 1.40 | 13.1 | 9.96 | 8.56 |
| Total and averages | 2 | | | | 5.70 | 14.5 | 11.02 | 5.32 |

## TOBACCO.

There have been reported the results of 284 tests of fertilizers applied to soils for tobacco as follows: 98 in Ohio, 44 in Kentucky, 38 in North Carolina, 37 in Louisiana, 27 in Pennsylvania, 26 in Connecticut, 9 in Maryland, and 5 in Virginia. The results of these tests are given in the following table:

*Results of fertilizer tests with tobacco soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 5 | 5.0 : 0 | 360 to 2,720 | 160 | 4.00 | 963 |
| Acid phosphate | 12 | 6.0 : 1 | −150 to 565 | 391 | 2.74 | 186 |
| Sulphate of potash | 6 | 6.0 : 0 | 180 to 654 | 200 | 6.00 | 378 |
| Muriate of potash | 1 | 1.0 : 0 | 840 | 160 | 3.52 | 840 |
| Kainit | 4 | 4.0 : 0 | 80 to 125 | 394 | 2.36 | 101 |
| Cotton-seed hull ashes | 1 | 1.0 : 0 | 240 | 1,000 | 17.00 | 240 |
| Carbonate of potash and magnesia | 3 | 3.0 : 0 | 560 to 765 | 480 | .......... | 683 |
| Total and averages | 32 | .......... | .................... | .......... | 4.10 | 373 |
| MIXTURES OF TWO MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate | 10 | 9.0 : 1 | — 50 to 2,920 | 178<br>330 | 6.76 | 741 |
| Nitrate of soda<br>Sulphate of potash | 2 | 2.0 : 0 | 530 to 645 | 160<br>160 | 8.80 | 588 |
| Nitrate of soda<br>Muriate of potash | 3 | 3.0 : 0 | 306 to 481 | 240<br>180 | 9.96 | 387 |
| Nitrate of soda<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 105 | 160<br>300 | .......... | 105 |
| Nitrate of potash<br>Acid phosphate | 3 | 3.0 : 1 | 795 to 882 | 200<br>173 | 6.21 | 839 |
| Acid phosphate<br>Sulphate of potash | 4 | 4.0 : 0 | 38 to 490 | 310<br>168 | 7.19 | 265 |
| Acid phosphate<br>Muriate of potash | 4 | 4.0 : 0 | 401 to 743 | 395<br>175 | 6.62 | 556 |
| Acid phosphate<br>Kainit | 4 | 4.0 : 0 | 70 to 87 | 381<br>197 | 3.15 | 78 |
| Acid phosphate<br>Cotton-seed hull ashes | 1 | 1.0 : 0 | 120 | 600<br>300 | 9.30 | 120 |
| Acid phosphate<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 90 | 140<br>300 | .......... | 90 |
| Total and averages | 33 | .......... | .................... | .......... | 6.80 | 516 |
| MIXTURES OF THREE OR MORE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 12 | 12.0 : 0 | 184 to 3,440 | 204<br>276<br>148 | 11.45 | 867 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 44 | 44.0 : 0 | 249 to 3,520 | 250<br>329<br>130 | 11.43 | 677 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 3 | 3.0 : 0 | 520 to 3,880 | 160<br>160<br>240 | 6.56 | 2,480 |
| Nitrate of soda<br>Acid phosphate<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 255 | 160<br>140<br>300 | .......... | 255 |

*Results of fertilizer tests with tobacco soils*—Continued.

MIXTURES OF THREE OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate<br>Cotton-seed hull ashes | 4 | 4.0 : 0 | 380 to 3,320 | 145<br>270<br>180 | 8.57 | 1,812 |
| Nitrate of soda<br>Acid phosphate<br>Nitrate of potash | 3 | 3.0 : 0 | 271 to 643 | 80<br>480<br>200 | 10.36 | 483 |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 10 | 10.0 : 1 | 38 to 3,320 | 159<br>307<br>126 | 10.86 | 886 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash<br>Lime | 3 | 3.0 : 0 | 301 to 696 | 240<br>480<br>180<br>1,000 | 17.76 | 537 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 391 to 586 | 240<br>480<br>180<br>1,000 | 16.32 | 488 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 543 to 576 | 180<br>480<br>180<br>1,000 | 15.90 | 560 |
| Total and averages | 84 | .......... | .......... | .......... | 11.48 | 830 |

ORGANIC FERTILIZERS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Cotton-seed meal | 5 | 5.0 : 0 | 70 to 104 | 545 | 6.81 | 88 |

ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Dried blood<br>Nitrate of soda | 1 | 1.0 : 0 | 350 | 80<br>80 | 3.60 | 350 |
| Tankage<br>Muriate of potash | 3 | 3.0 : 0 | 33 to 371 | 670<br>180 | 12.67 | 230 |
| Cotton-seed meal<br>Acid phosphate | 5 | 5.0 : 0 | 80 to 306 | 535<br>425 | 9.66 | 144 |
| Cotton-seed meal<br>Sulphate of potash | 9 | 9.0 : 0 | 277 to 1,867 | 1,306<br>236 | 23.39 | 774 |
| Cotton-seed meal<br>Kainit | 4 | 4.0 : 0 | 50 to 100 | 253<br>253 | 4.68 | 73 |
| Cotton-seed meal<br>Cotton-seed hull ashes | 3 | 3.0 : 0 | 580 to 640 | 2,333<br>1,567 | 55.80 | 603 |
| Cotton-seed meal<br>Carbonate of potash and magnesia | 4 | 4.0 : 0 | 736 to 1,380 | 1,219<br>646 | .......... | 1.101 |
| Linseed meal<br>Cotton-seed hull ashes | 1 | 1.0 : 0 | 540 | 1,760<br>1,660 | 61.66 | 540 |
| Castor pomace<br>Cotton-seed hull ashes | 3 | 3.0 : 0 | 580 to 730 | 3,513<br>1,580 | .......... | 667 |
| Total and averages | 33 | .......... | .......... | .......... | 21.09 | 437 |

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Dried blood<br>Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 330 | 80<br>80<br>140 | 4.58 | 330 |
| Dried blood<br>Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 730 | 80<br>80<br>160 | 7.12 | 730 |
| Dried blood<br>Acid phosphate<br>Sulphate of potash | 5 | 5.0 : 0 | 152 to 2.760 | 210<br>179<br>88 | 8.09 | 786 |

*Results of fertilizer tests with tobacco soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Tankage<br>Muriate of potash<br>Lime | 4 | 4.0 : 0 | 171 to 466 | 670<br>180<br>1,000 | 15.67 | 328 |
| Fish scrap<br>Double manure salt<br>Coopers' bone | 1 | 1.0 : 0 | 450 | 1,300<br>1,220<br>200 | ......... | 450 |
| Cotton-seed meal<br>Sulphate of ammonia<br>Sulphate of potash | 2 | 2.0 : 0 | 431 to 1,453 | 1,219<br>221<br>246 | 29.47 | 942 |
| Cotton-seed meal<br>Acid phosphate<br>Sulphate of potash | 20 | 20.0 : 0 | 95 to 2,720 | 921<br>482<br>165 | 19.82 | 861 |
| Cotton-seed meal<br>Acid phosphate<br>Kainit | 8 | 8.0 : 0 | 80 to 120 | 155<br>225<br>118 | 4.22 | 104 |
| Cotton-seed meal<br>Acid phosphate<br>Carbonate of potash and magnesia | 4 | 4.0 : 0 | 1,187 to 2,452 | 1,219<br>793<br>646 | ......... | 1,694 |
| Cotton-seed meal<br>Sulphate of potash<br>Cooper's bone | 1 | 1.0 : 0 | 680 | 1,500<br>620<br>360 | ......... | 680 |
| Cotton-seed meal<br>Carbonate of potash<br>Cooper's bone | 1 | 1.0 : 0 | 540 | 1,500<br>580<br>360 | ......... | 540 |
| Cotton-seed meal<br>Double carbonate of potash and magnesia<br>Cooper's bone | 1 | 1.0 : 0 | 530 | 1,500<br>740<br>360 | ......... | 530 |
| Cotton-seed meal<br>Wood ashes<br>Cooper's bone | 1 | 1.0 : 0 | 570 | 1,500<br>5,620<br>160 | ......... | 570 |
| Cotton-seed meal<br>Double manure salt<br>Cooper's bone | 1 | 1.0 : 0 | 830 | 1,500<br>1,220<br>360 | ......... | 830 |
| Linseed meal<br>Cotton-seed hull ashes<br>Cooper's bone | 1 | 1.0 : 0 | 670 | 1,760<br>660<br>260 | ......... | 670 |
| Castor pomace<br>Nitrate of soda<br>Cotton-seed hull ashes | 2 | 2.0 : 0 | 700 to 810 | 2,260<br>656<br>1,660 | ......... | 755 |
| Dried blood<br>Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 2 | 2.0 : 0 | 220 to 251 | 90<br>86<br>357<br>120 | 10.05 | 235 |
| Dried blood<br>Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 910 to 1,070 | 120<br>120<br>210<br>240 | 12.15 | 990 |
| Dried blood<br>Nitrate of soda<br>Acid phosphate<br>Cotton-seed hull ashes | 1 | 1.0 : 0 | 380 | 100<br>100<br>600<br>300 | 13.80 | 380 |
| Dried blood<br>Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 273 | 80<br>50<br>114<br>120 | 7.55 | 273 |
| Tankage<br>Sulphate of ammonia<br>Muriate of potash<br>Lime | 1 | 1.0 : 0 | 391 | 670<br>180<br>180<br>1,000 | 21.25 | 391 |
| Fish scrap<br>Nitrate of soda<br>Cooper's bone<br>Lime | 1 | 1.0 : 0 | 820 | 880<br>440<br>720<br>300 | ......... | 820 |

*Results of fertilizer tests with tobacco soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Cotton-seed meal | 1 | 1.0 : 0 | 730 | 1,500 | ........ | 730 |
| Sulphate of potash | | | | 620 | | |
| Cooper's bone | | | | 360 | | |
| Lime | | | | 300 | | |
| Cotton-seed meal | 1 | 1.0 : 0 | 590 | 1,500 | ........ | 590 |
| Double manure salt | | | | 1,220 | | |
| Cooper's bone | | | | 360 | | |
| Lime | | | | 300 | | |
| Dried blood | 1 | 1.0 : 0 | 98 | 60 | 10.76 | 98 |
| Fish scrap | | | | 60 | | |
| Nitrate of soda | | | | 60 | | |
| Sulphate of ammonia | | | | 60 | | |
| Acid phosphate | | | | 200 | | |
| Sulphate of potash | | | | 120 | | |
| Total and averages | 65 | ........ | ........ | ........ | 14.31 | 609 |

MANURE AND COMBINATIONS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Manure | 16 | 16.0 : 0 | 20 to 1,827 | 27,563 | 6.89 | 569 |
| Manure | 6 | 6.0 : 0 | 303 to 506 | 20,000 | 8.00 | 375 |
| Lime | | | | 1,000 | | |
| Manure | 1 | 1.0 : 0 | 153 | 16,000 | 10.44 | 153 |
| Nitrate of soda | | | | 160 | | |
| Acid phosphate | | | | 160 | | |
| Muriate of potash | | | | 60 | | |
| Total and averages | 23 | ........ | ........ | ........ | 7.33 | 500 |

COMMERCIAL FERTILIZERS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 9 | 9.0 : 0 | 80 to 1,050 | 2,614 | 26.14 | 581 |

## BEANS.

There have been reported the results of 297 tests of fertilizers applied to soils for beans as follows: 93 in Michigan, 77 in New York, 67 in Maine, and 60 in Rhode Island. The results of these tests are given in the following table:

*Results of fertilizer tests with bean soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 11 | 1.7 : 1 | −156 to 840 | 123 | 3.07 | 172 |
| Acid phosphate | 29 | 4.8 : 1 | − 40 to 690 | 303 | 2.12 | 171 |
| Muriate of potash | 22 | 1.4 : 1 | −200 to 400 | 136 | 2.99 | 97 |
| Wood ashes | 2 | 2.0 : 0 | 30 to 72 | 1,500 | 3.75 | 51 |
| Lime | 2 | 1.0 : 1 | − 90 to 90 | 1,500 | 4.50 | 0 |
| Total and averages | 66 | ........ | ........ | ........ | 2.69 | 138 |

*Results of fertilizer tests with bean soils*—Continued.

### MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 11 | 0.4 : 1 | −444 to 534 | 123 | 4.85 | − 29 |
| Acid phosphate | | | | 255 | | |
| Nitrate of soda | 10 | 1.0 : 1 | −978 to 1,092 | 120 | 5.64 | − 3 |
| Muriate of potash | | | | 120 | | |
| Sulphate of ammonia | 2 | 2.0 : 0 | 12 to 66 | 150 | 6.85 | 39 |
| Muriate of potash | | | | 100 | | |
| Acid phosphate | 30 | 3.3 : 1 | −444 to 564 | 310 | 5.02 | 134 |
| Muriate of potash | | | | 129 | | |
| Total and averages | 53 | | | | 5.17 | 71 |

### MIXTURES OF THREE OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda | 13 | 1.2 : 1 | −360 to 1,212 | 162 | 8.69 | 111 |
| Acid phosphate | | | | 277 | | |
| Muriate of potash | | | | 123 | | |
| Sulphate of ammonia | 17 | 17.0 : 0 | 25 to 816 | 160 | 10.08 | 246 |
| Acid phosphate | | | | 288 | | |
| Muriate of potash | | | | 141 | | |
| Sulphate of ammonia | 2 | 2.0 : 0 | 156 to 294 | 150 | 11.35 | 225 |
| Rock phosphate | | | | 1,000 | | |
| Muriate of potash | | | | 100 | | |
| Lime | 1 | 0.0 : 1 | − 30 | 1,500 | 14.25 | − 30 |
| Wood ashes | | | | 1,500 | | |
| Salt | | | | 1,500 | | |
| Nitrate of soda | 1 | 1.0 : 0 | 72 | 120 | 13.32 | 72 |
| Acid phosphate | | | | 240 | | |
| Muriate of potash | | | | 120 | | |
| Lime | | | | 2,000 | | |
| Sulphate of ammonia | 6 | 2.0 : 1 | − 85 to 95 | 200 | | 32 |
| Acid phosphate | | | | 200 | | |
| Muriate of potash | | | | 200 | | |
| Chalk | | | | 185 | | |
| Total and averages | 40 | | | | 9.85 | 180 |

### ORGANIC FERTILIZERS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood | 11 | 10.0 : 1 | 0 to 339 | 200 | 4.00 | 120 |
| Ground bone | 6 | 5.0 : 1 | −6 to 84 | 400 | 5.20 | 39 |
| Total and averages | 17 | | | | 4.31 | 92 |

### ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood | 11 | 2.7 : 1 | − 97 to 605 | 200 | 6.10 | 210 |
| Acid phosphate | | | | 300 | | |
| Dried blood | 11 | 4.5 : 1 | −150 to 484 | 200 | 7.30 | 153 |
| Muriate of potash | | | | 150 | | |
| Total and averages | 22 | | | | 6.70 | 181 |

### ORGANIC FERTILIZERS WITH TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood | 13 | 5.5 : 1 | − 37 to 605 | 255 | 10.59 | 200 |
| Acid phosphate | | | | 323 | | |
| Muriate of potash | | | | 146 | | |
| Boneblack | 6 | 1.0 : 1 | − 85 to 55 | 200 | 12.80 | − 10 |
| Sulphate of ammonia | | | | 200 | | |
| Muriate of potash | | | | 200 | | |
| Guano | 2 | 2.0 : 0 | 150 to 156 | 725 | 24.97 | 153 |
| Sulphate of ammonia | | | | 150 | | |
| Muriate of potash | | | | 100 | | |
| Total and averages | 21 | | | | 12.59 | 135 |

*Results of fertilizer tests with bean soils*—Continued.

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Manure | 9 | 8.0 : 1 | −240 to 2,262 | 40,000 | 10.00 | 405 |
| Manure<br>Nitrate of soda | 12 | 5.0 : 1 | −151 to 691 | 28,440<br>1,000 | 32.11 | 197 |
| Manure<br>Sulphate of ammonia | 12 | 1.4 : 1 | −303 to 453 | 28,440<br>1,000 | 38.11 | 72 |
| Manure<br>Acid phosphate | 12 | 5.0 : 1 | 0 to 892 | 28,440<br>1,000 | 14.11 | 422 |
| Manure<br>Sulphate of potash | 12 | 11.0 : 1 | −151 to 757 | 28,440<br>1,000 | 37.11 | 278 |
| Manure<br>Muriate of potash | 12 | 5.0 : 1 | − 76 to 907 | 28,440<br>1,000 | 29.11 | 223 |
| Total and averages | 69 | | | | 27.49 | |

COMMERCIAL FERTILIZERS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 9 | 1.2 : 1 | −600 to 564 | 480 | 4.80 | 2 |

## SUGAR BEETS.

The number of recorded tests on soils for sugar beets is 654, distributed as follows: Michigan 356, Wisconsin 93, New York 90, Nebraska 43, Colorado 36, Arkansas 13, South Carolina 9, Delaware 7, and Illinois 7. The results of these tests are embodied in the following table:

*Results of fertilizer tests with sugar-beet soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease. per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 53 | 3.4 : 1 | −11,340 to 10,160 | 195 | 4.96 | 2,007 |
| Sulphate of ammonia | 4 | 3.0 : 1 | − 190 to 1,010 | 190 | 5.89 | 365 |
| Acid phosphate | 49 | 1.1 : 1 | − 4,327 to 11,184 | 312 | 2.18 | 1,085 |
| Basic slag | 2 | 2.0 : 0 | 2,280 to 2,780 | 400 | 2.50 | 2,530 |
| Sulphate of potash | 21 | 4.2 : 1 | − 2,749 to 5,433 | 208 | 6.23 | 1,794 |
| Muriate of potash | 27 | 1.7 : 1 | − 4,720 to 10,204 | 150 | 3.31 | 1,596 |
| Kainit | 8 | 8.0 : 0 | 53 to 15,200 | 244 | 1.46 | 3,623 |
| Wood ashes | 9 | 3.5 : 1 | − 1,810 to 16,759 | 1,888 | 4.72 | 6,374 |
| Lime | 23 | 4.7 : 1 | − 6,777 to 11,340 | 3,863 | 11.59 | 3,729 |
| Salt | 7 | 1.3 : 1 | − 3,440 to 1,340 | 871 | 3.48 | − 223 |
| Sand | 1 | 1.0 : 0 | 2,647 | 310,000 | | 2,647 |
| Total and averages | 205 | | | | 4.72 | 2,046 |

*Results of fertilizer tests with sugar-beet soils*—Continued.

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate | 40 | 4.7 : 1 | −1,613 to 9,800 | 157<br>282 | 5.90 | 3,128 |
| Nitrate of soda<br>Basic slag | 1 | 1.0 : 0 | 3,816 | 360<br>540 | 12.35 | 3,816 |
| Nitrate of soda<br>Sulphate of potash | 6 | 6.0 : 0 | 393 to 11,887 | 187<br>146 | 9.06 | 5,992 |
| Nitrate of soda<br>Muriate of potash | 32 | 5.4 : 1 | − 764 to 12,340 | 154<br>157 | 7.30 | 3,961 |
| Nitrate of soda<br>Kainit | 3 | 3.0 : 0 | 4,600 to 6,146 | 227<br>347 | 7.75 | 5,182 |
| Nitrate of soda<br>Lime | 2 | 1.0 : 1 | −2,493 to 1,693 | 300<br>2,000 | 13.50 | − 400 |
| Acid phosphate<br>Sulphate of potash | 17 | 7.5 : 1 | −1,045 to 10,504 | 371<br>187 | 8.21 | 3,212 |
| Acid phosphate<br>Muriate of potash | 38 | 11.7 : 1 | − 614 to 9,396 | 292<br>166 | 5.69 | 2,843 |
| Acid phosphate<br>Kainit | 4 | 4.0 : 0 | 1,000 to 4,718 | 156<br>156 | 2.03 | 2,879 |
| Acid phosphate<br>Lime | 3 | 2.0 : 1 | −6,307 to 18,740 | 347<br>2,000 | 8.43 | 9,718 |
| Rock phosphate<br>Lime | 1 | 0.0 : 1 | −1,439 | 800<br>2,000 | 9.60 | −1,439 |
| Muriate of potash<br>Basic slag | 1 | 1.0 : 0 | 1,996 | 144<br>540 | 6.52 | 1,996 |
| Muriate of potash<br>Lime | 2 | 2.0 : 0 | 220 to 4,312 | 300<br>2,000 | 12.60 | 2,266 |
| Total and averages | 135 | .......... | .................. | .......... | 6.05 | 3,813 |

MIXTURES OF THREE OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 18 | 8.0 : 1 | −3,369 to 13,477 | 271<br>358<br>190 | 14.98 | 6,165 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 45 | 21.5 : 1 | − 852 to 14,431 | 161<br>296<br>146 | 9.32 | 5,667 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 4 | 4.0 : 0 | 1,400 to 11,350 | 89<br>139<br>239 | 4.63 | 7,039 |
| Nitrate of soda<br>Acid phosphate<br>Carbonate of potash and magnesia | 2 | 1.0 : 1 | 0 to 736 | 360<br>360<br>412 | ........ | 368 |
| Nitrate of soda<br>Acid phosphate<br>Lime | 1 | 0.0 : 1 | −1,393 | 200<br>400<br>2,000 | 13.80 | −1,393 |
| Nitrate of soda<br>Rock phosphate<br>Lime | 1 | 1.0 : 0 | 3,625 | 400<br>800<br>2,000 | 19.60 | 3,625 |
| Nitrate of soda<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 4,693 to 8,983 | 300<br>300<br>2,000 | 20.10 | 6,838 |
| Nitrate of potash<br>Acid phosphate<br>Silica of potash | 1 | 1.0 : 0 | 5,613 | 360<br>360<br>680 | ........ | 5,613 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 8 | 8.0 : 0 | 1,190 to 8,540 | 84<br>275<br>120 | 7.19 | 3,472 |
| Acid phosphate<br>Muriate of potash<br>Lime | 1 | 1.0 : 0 | 4,840 | 400<br>200<br>2,000 | 13.20 | 4,840 |

*Results of fertilizer tests with sugar-beet soils*—Continued.

MIXTURES OF THREE OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Rock phosphate<br>Muriate of potash<br>Lime | 1 | 1.0 : 0 | 9,874 | 800<br>400<br>2,000 | 18.40 | 9,874 |
| Lime<br>Ashes<br>Salt | 1 | 1.0 : 0 | 8,110 | 1,500<br>1,500<br>1,500 | 14.25 | 8,110 |
| Nitrate of soda<br>Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 2 | 1.0 : 1 | −59 to 1,910 | 50<br>50<br>300<br>100 | 7.90 | 925 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 3,070 to 3,940 | 120<br>240<br>120<br>2,000 | 13.32 | 3,505 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash<br>Lime | 1 | 1.0 : 0 | 820 | 95<br>240<br>120<br>2,000 | 13.27 | 820 |
| Total and averages | 90 | | | | 10.80 | 5,406 |

ORGANIC FERTILIZERS—SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Ground bone | 5 | 5.0 : 0 | 520 to 4,180 | 238 | 3.10 | 1,888 |
| Cotton-seed meal | 4 | 4.0 : 0 | 835 to 4,464 | 175 | 2.19 | 2,092 |
| Total and averages | 9 | | | | 2.70 | 1,958 |

ORGANIC FERTILIZERS WITH ONE MINERAL.

| | | | | | | |
|---|---|---|---|---|---|---|
| Ground bone<br>Nitrate of soda | 3 | 3.0 : 0 | 2,000 to 8,300 | 200<br>167 | 6.77 | 4,127 |
| Ground bone<br>Kainit | 2 | 2.0 : 0 | 1,400 | 150<br>150 | 2.85 | 1,400 |
| Guano<br>Kainet | 2 | 1.0 : 1 | −1,200 to 2,400 | 150<br>150 | 4.65 | 600 |
| Cotton-seed meal<br>Acid phosphate | 3 | 0.0 : 3 | − 747 to −107 | 100<br>100 | 1.95 | −440 |
| Cotton-seed meal<br>Kainit | 1 | 1.0 : 0 | 133 | 150<br>150 | 2.77 | 133 |
| Total and averages | 11 | | | | 3.99 | 1,381 |

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Ground bone<br>Nitrate of soda<br>Sulphate of potash | 1 | 1.0 : 0 | 1,906 | 360<br>360<br>144 | 18.00 | 1,906 |
| Ground bone<br>Nitrate of soda<br>Kainit | 1 | 1.0 : 0 | 6,600 | 133<br>133<br>133 | 5.85 | 6,600 |
| Ground bone<br>Muriate of potash<br>Lime | 3 | 3.0 : 0 | 25,960 to 30,460 | 320<br>160<br>2,000 | 13.68 | 28,813 |
| Ground bone<br>Guano<br>Kainit | 1 | 0.0 : 1 | −1,000 | 133<br>133<br>133 | 5.85 | −1,000 |
| Guano<br>Acid phosphate<br>Kainit | 1 | 0.0 : 1 | −2,200 | 66<br>66<br>66 | 2.51 | −2,200 |

*Results of fertilizer tests with sugar-beet soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Cotton-seed meal<br>Kainit<br>Acid phosphate | 1 | 1.0 : 0 | 10,218 | 150<br>150<br>100 | 3.47 | 10,218 |
| Dried blood<br>Nitrate of soda<br>Acid phosphate<br>Sulphate of potash<br>Carbonate of potash | 4 | 1.0 : 1 | −4,740 to 1,780 | 75<br>75<br>250<br>50<br>75 | ........ | − 540 |
| Total and averages | 12 | ........ | ........ | ........ | 9.59 | 12,745 |

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Manure | 84 | 27.0 : 1 | −2,931 to 16,020 | 38,810 | 9.70 | 6,168 |
| Manure<br>Nitrate of soda | 2 | 2.0 : 0 | 4,380 to 7,580 | 30,000<br>150 | 11.25 | 5,980 |
| Total and averages | 86 | ........ | ........ | ........ | 9.74 | 6,164 |

COMMERCIAL FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 101 | 8.2 : 1 | −3,705 to 11,250 | 727 | 7.27 | 3,711 |
| Commercial fertilizer<br>Lime | 5 | 5.0 : 0 | 1,740 to 5,140 | 474<br>2,000 | 10.74 | 2,726 |
| Total and averages | 106 | ........ | ........ | ........ | 7.43 | 3,664 |

## SUGAR CANE.

There have been recorded the results of 510 tests of substances applied to soils for sugar cane in Louisiana and Mississippi. The results have been embodied in the following table:

*Results of fertilizer tests with sugar-cane soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 6 | 5.0 : 1 | −3,000 to 26,020 | 148 | 3.71 | 9,017 |
| Sulphate of ammonia | 5 | 5.0 : 0 | 4,020 to 25,880 | 114 | 3.55 | 9,332 |
| Acid phosphate | 15 | 2.8 : 1 | −1,600 to 20,980 | 316 | 2.21 | 4,857 |
| Floats | 4 | 4.0 : 0 | 2,720 to 16,180 | 512 | 2.05 | 8,910 |
| Basic slag | 4 | 4.0 : 0 | 3,460 to 7,360 | 512 | 3.20 | 5,540 |
| Sulphate of potash | 5 | 1.5 : 1 | −1,720 to 3,500 | 60 | 1.80 | 600 |
| Muriate of potash | 6 | 0.5 : 1 | −4,240 to 6,720 | 67 | 1.47 | 289 |
| Kainit | 14 | 3.7 : 1 | −6,800 to 13,720 | 325 | 1.95 | 393 |
| Cotton seed hull ashes | 5 | 1.5 : 1 | −5,200 to 17,360 | 210 | 3.57 | 2,768 |
| Carbonate of potash | 1 | 0.0 : 1 | −1,000 | 140 | ........ | −1,000 |
| Gypsum | 3 | 2.0 : 1 | −4,700 to 2,600 | 425 | 1.70 | − 300 |
| Total and averages | 68 | ........ | ........ | ........ | 2.42 | 3,681 |

*Results of fertilizer tests with sugar-cane soils*—Continued.

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Sulphate of ammonia<br>Acid phosphate | 2 | 1.0 : 1 | − 400 to 2,200 | 230<br>480 | 10.49 | 900 |
| Sulphate of ammonia<br>Sulphate of potash | 8 | 7.0 : 1 | −5,000 to 11,980 | 230<br>100 | 10.13 | 6,635 |
| Acid phosphate<br>Sulphate of potash | 8 | 7.0 : 1 | − 140 to 18,180 | 504<br>100 | 6.53 | 11,053 |
| Acid phosphate<br>Muriate of potash | 8 | 1.7 : 1 | −5,600 to 9,920 | 444<br>107 | 5.47 | 703 |
| Acid phosphate<br>Kainit | 4 | 4.0 : 0 | 1,880 to 7,020 | 300<br>300 | 3.90 | 3,740 |
| Total and averages | 30 | | | | 7.12 | 5,463 |
| MIXTURES OF THREE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 8 | 8.0 : 0 | 2,380 to 14,080 | 240<br>504<br>100 | 12.53 | 7,883 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 5 | 4.0 : 1 | − 600 to 26,400 | 270<br>470<br>100 | 12.24 | 14,004 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 8 | 8.0 : 0 | 1,580 to 16,500 | 319<br>350<br>93 | 11.00 | 9,988 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of ammonia | 2 | 2.0 : 0 | 2,700 to 5,580 | 84<br>500<br>171 | 10.90 | 4,140 |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 21 | 20.0 : 1 | − 200 to 22,100 | 218<br>441<br>98 | 12.78 | 9,591 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 12 | 11.0 : 1 | − 1,000 to 27,600 | 233<br>469<br>88 | 12.43 | 14,954 |
| Sulphate of ammonia<br>Floats<br>Sulphate of potash | 3 | 3.0 : 0 | 6,680 to 13,660 | 230<br>516<br>100 | 12.19 | 9,473 |
| Sulphate of ammonia<br>Acid phosphate<br>Kainit | 11 | 10.0 : 1 | − 1,600 to 21,380 | 204<br>387<br>144 | 9.89 | 10,538 |
| Sulphate of ammonia<br>Acid phosphate<br>Cotton-seed hull ashes | 1 | 1.0 : 0 | 5,000 | 230<br>480<br>200 | 13.89 | 5,000 |
| Sulphate of ammonia<br>Basic slag<br>Sulphate of potash | 3 | 3.0 : 0 | 6,180 to 21,780 | 230<br>516<br>100 | 13.35 | 12,107 |
| Sulphate of ammonia<br>Sulphate of potash<br>Gypsum | 2 | 0.0 : 2 | − 8,000 to −5,400 | 230<br>100<br>387 | 11.68 | −6,700 |
| Nitrate of potash<br>Sulphate of ammonia<br>Acid phosphate | 2 | 1.0 : 1 | − 1,200 to 1,600 | 159<br>230<br>480 | 14.47 | 200 |
| Total and averages | 78 | | | | 12.05 | 10,072 |
| ORGANIC FERTILIZERS SINGLY. | | | | | | |
| Dried blood | 5 | 4.0 : 1 | − 500 to 15,260 | 205 | 4.10 | 6,816 |
| Tankage | 21 | 21.0 : 0 | 940 to 19,440 | 557 | 7.24 | 7,433 |
| Boneblack | 5 | 0.7 : 1 | −3,000 to 4,040 | 513 | 5.64 | 668 |
| Ground bone | 5 | 5.0 : 0 | 1,600 to 9,340 | 513 | 6.67 | 5,284 |
| Fish scrap | 5 | 4.0 : 1 | − 720 to 16,080 | 248 | 4.96 | 6,500 |
| Cotton seed | 4 | 4.0 : 0 | 3,760 to 11,700 | 1,700 | 13.60 | 8,445 |
| Cotton-seed meal | 15 | 14.0 : 1 | − 720 to 15,620 | 466 | 5.83 | 6,837 |
| Total and averages | 60 | | | | 6.68 | 6,479 |

*Results of fertilizer tests with sugar-cane soils*—Continued.

### ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Tankage<br>Sulphate of potash | 1 | 1.0 : 0 | 4,160 | 400<br>100 | 7.20 | 4,160 |
| Tankage<br>Kainit | 4 | 4.0 : 0 | 13,860 to 25,080 | 900<br>300 | 13.50 | 17,535 |
| Tankage<br>Cotton-seed hull ashes | 4 | 4.0 : 0 | 400 to 12,180 | 900<br>300 | 16.80 | 8,225 |
| Tankage<br>Gypsum | 1 | 1.0 : 0 | 12,660 | 900<br>200 | 12.50 | 12,660 |
| Ground bone<br>Sulphate of potash | 5 | 1.5 : 1 | −1,020 to 9,340 | 513<br>100 | 9.66 | 3,040 |
| Cotton seed<br>Acid phosphate | 4 | 4.0 : 0 | 9,820 to 14,980 | 1,700<br>300 | 15.70 | 12,325 |
| Cotton seed<br>Floats | 4 | 4.0 : 0 | 880 to 9,220 | 1,700<br>300 | 14.80 | 6,800 |
| Cotton seed<br>Cotton-seed hull ashes | 4 | 4.0 : 0 | 8,700 to 14,380 | 1,700<br>300 | 18.70 | 11,135 |
| Cotton-seed meal<br>Acid phosphate | 41 | 41.0 : 0 | 3,120 to 40,520 | 425<br>278 | 7.26 | 13,733 |
| Cotton-seed meal<br>Floats | 22 | 10.0 : 1 | −1,200 to 31,180 | 415<br>235 | 6.12 | 8,350 |
| Cotton-seed meal<br>Kainit | 8 | 3.0 : 1 | −2,220 to 22,200 | 535<br>535 | 9.90 | 11,438 |
| Cotton-seed meal<br>Cotton-seed hull ashes | 2 | 2.0 : 0 | 6,040 to 16,540 | 500<br>500 | 14.75 | 11,290 |
| Cotton-seed meal<br>Ground bone | 2 | 2.0 : 0 | 19,060 to 21,400 | 500<br>500 | 12.75 | 20,230 |
| Cotton-seed meal<br>Guano | 2 | 2.0 : 0 | 15,100 to 28,360 | 500<br>500 | 18.75 | 21,730 |
| Total and averages | 104 | | | | 9.52 | 11,547 |

### ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate<br>Sulphate of potash | 8 | 7.0 : 1 | − 980 to 10,060 | 300<br>504<br>100 | 12.53 | 5,220 |
| Dried blood<br>Acid phosphate<br>Muriate of postash | 7 | 6.0 : 1 | 0 to 23,280 | 347<br>479<br>91 | 12.30 | 13,454 |
| Tankage<br>Acid phosphate<br>Sulphate of potash | 4 | 4.0 : 0 | 3,340 to 16,360 | 400<br>504<br>100 | 11.73 | 8,130 |
| Tankage<br>Kainit<br>Gypsum | 5 | 5.0 : 0 | 15,220 to 25,180 | 900<br>300<br>200 | 14.30 | 18,632 |
| Boneblack<br>Sulphate of ammonia<br>Sulphate of potash | 10 | 9.0 : 1 | −1,880 to 19,600 | 457<br>218<br>100 | 14.80 | 7,048 |
| Ground bone<br>Sulphate of ammonia<br>Sulphate of potash | 4 | 1.0 : 1 | −2,670 to 7,080 | 516<br>230<br>100 | 16.84 | 2,362 |
| Fish scrap<br>Acid phosphate<br>Sulphate of potash | 4 | 4.0 : 0 | 4,260 to 19,180 | 310<br>504<br>100 | 12.73 | 10,800 |
| Fish scrap<br>Acid phosphate<br>Muriate of potash | 7 | 7.0 : 0 | 5,000 to 15,360 | 529<br>479<br>91 | 15.93 | 12,503 |
| Cotton seed<br>Acid phosphate<br>Kainit | 4 | 3.0 : 1 | −9,400 to 18,980 | 1,700<br>300<br>300 | 17.50 | 7,855 |

*Results of fertilizer tests with sugar-cane soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Cotton seed<br>Floats<br>Gypsum | 4 | 4.0 : 0 | 800 to 17,340 | 1,700<br>300<br>200 | 15.60 | 12,145 |
| Cotton-seed meal<br>Acid phosphate<br>Sulphate of potash | 8 | 8.0 : 0 | 7,160 to 24,020 | 525<br>504<br>100 | 13.09 | 14,825 |
| Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 10 | 10.0 : 0 | 7,960 to 24,080 | 681<br>485<br>85 | 13.78 | 14,650 |
| Cotton-seed meal<br>Acid phosphate<br>Kainit | 33 | 15.5 : 1 | −4,000 to 32,000 | 501<br>361<br>319 | 10.70 | 15,486 |
| Cotton-seed meal<br>Kainit<br>Gypsum | 3 | 2.0 : 1 | −1,440 to 7,760 | 540<br>340<br>540 | 10.95 | 2,533 |
| Cotton-seed meal<br>Floats<br>Kainit | 10 | 10.0 : 0 | 7,340 to 30,660 | 562<br>358<br>412 | 10.93 | 15,737 |
| Cotton-seed meal<br>Floats<br>Cotton-seed hull ashes | 5 | 5.0 : 0 | 1,330 to 16,420 | 600<br>300<br>300 | 13.80 | 10,566 |
| Cotton-seed meal<br>Kainit<br>Cotton-seed hull ashes | 2 | 2.0 : 0 | 220 to 14,220 | 500<br>500<br>500 | 17.75 | 7,220 |
| Ground bone<br>Cotton-seed meal<br>Kainit | 5 | 5.0 : 0 | 14,220 to 25,180 | 524<br>416<br>524 | 15.10 | 18,728 |
| Cotton-seed meal<br>Guano<br>Kainit | 2 | 2.0 : 0 | 16,680 to 26,060 | 500<br>500<br>500 | 21.75 | 21,370 |
| Dried blood<br>Sulphate of ammonia<br>Acid phosphate<br>Kainit | 4 | 4.0 : 0 | 4,820 to 14,880 | 200<br>125<br>300<br>100 | 10.57 | 9,970 |
| Dried blood<br>Sulphate of ammonia<br>Acid phosphate<br>Kainit | 2 | 2.0 : 0 | 4,800 to 23,620 | 200<br>100<br>300<br>100 | 9.80 | 14,210 |
| Cotton-seed meal<br>Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 5,360 to 13,960 | 350<br>225<br>500<br>70 | 15.04 | 9,660 |
| Dried blood<br>Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 7,880 to 9,760 | 270<br>350<br>500<br>70 | 14.81 | 8,820 |
| Fish scrap<br>Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 14,660 to 15,360 | 525<br>350<br>500<br>70 | 19.91 | 15,010 |
| Cotton-seed meal<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 11,380 to 11,860 | 350<br>180<br>500<br>70 | 15.00 | 11,620 |
| Cotton-seed meal<br>Floats<br>Kainit<br>Gypsum | 3 | 3.0 : 0 | 7,700 to 28,520 | 600<br>300<br>300<br>200 | 11.30 | 17,320 |
| Dried blood<br>Cotton-seed meal<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 3 | 3.0 : 0 | 23,940 to 38,320 | 120<br>200<br>140<br>440<br>80 | 14.08 | 29,653 |
| Dried blood<br>Cotton-seed meal<br>Sulphate of ammonia<br>Acid phosphate<br>Muriatic acid | 1 | 1.0 : 0 | 19,460 | 120<br>200<br>140<br>460<br>80 | ........ | 19,460 |

*Results of fertilizer tests with sugar-cane soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Cotton-seed meal | 3 | 3.0 : 0 | 2,980 to 18,800 | 240 | 13.77 | 9,527 |
| Nitrate of soda | | | | 100 | | |
| Sulphate of ammonia | | | | 80 | | |
| Acid phosphate | | | | 450 | | |
| Muriate of potash | | | | 120 | | |
| Cotton-seed meal | 6 | 6.0 : 0 | 5,660 to 23,580 | 175 | 10.33 | 12,740 |
| Nitrate of soda | | | | 117 | | |
| Sulphate of ammonia | | | | 82 | | |
| Acid phosphate | | | | 300 | | |
| Kainit | | | | 100 | | |
| Total and averages | 165 | | | | 13.09 | 12,820 |

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Manure | 2 | 1.0 : 1 | −800 to 1,020 | 11,000 | 2.75 | 110 |
| Manure | 1 | 1.0 : 0 | 2,380 | 20,000 | 7.10 | 2,380 |
| Acid phosphate | | | | 300 | | |
| Manure | 1 | 1.0 : 0 | 3,180 | 20,000 | 6.20 | 3,180 |
| Floats | | | | 300 | | |
| Manure | 1 | 1.0 : 0 | 4,460 | 20,000 | 8.90 | 4,460 |
| Acid phosphate | | | | 300 | | |
| Kainit | | | | 300 | | |
| Total and averages | 5 | | | | 5.54 | 2,048 |

## HEMP.

There have been recorded the results of 26 tests made in Kentucky of substances applied to soils for hemp, the results being continued in the following table:

*Results of fertilizer tests with hemp soils.*

MINERALS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 1 | 1.0 : 0 | 295 | 160 | 4.00 | 295 |
| Acid phosphate | 1 | 1.0 : 0 | 95 | 140 | .98 | 95 |
| Muriate of potash | 1 | 1.0 : 0 | 365 | 160 | 3.52 | 365 |
| Gypsum | 1 | 0.0 : 1 | −170 | 160 | .64 | −170 |
| Total and averages | 4 | | | | 2.28 | 146 |

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda | 1 | 1.0 : 0 | 305 | 160 | 5.12 | 305 |
| Acid phosphate | | | | 160 | | |
| Nitrate of soda | 1 | 1.0 : 0 | 405 | 160 | 7.52 | 405 |
| Muriate of potash | | | | 160 | | |
| Nitrate of soda | 1 | 1.0 : 0 | 410 | 160 | 4.00 | 410 |
| Soil | | | | 180 | | |

*Results of fertilizer tests with hemp soils*—Continued.

MIXTURES OF TWO MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Sulphate of ammonia<br>Acid phosphate | 1 | 0.0 : 1 | −7 | 310<br>600 | 13.81 | −7 |
| Sulphate of ammonia<br>Sulphate of potash | 1 | 1.0 : 0 | 373 | 300<br>200 | 15.30 | 373 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 395 | 140<br>160 | 4.50 | 395 |
| Acid phosphate<br>Soil | 1 | 1.0 : 0 | 140 | 320<br>320 | 2.24 | 140 |
| Muriate of potash<br>Soil | 1 | 1.0 : 0 | 330 | 160<br>480 | 3.52 | 330 |
| Total and averages | 8 | .......... | .......... | .......... | 7.00 | 294 |

MIXTURES OF THREE OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 5 | 5.0 : 0 | 315 to 800 | 192<br>284<br>160 | 10.31 | 655 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 2 | 2.0 : 0 | 780 to 800 | 160<br>320<br>240 | 13.44 | 790 |
| Nitrate of soda<br>Acid phosphate<br>Soil | 1 | 1.0 : 0 | 520 | 160<br>320<br>120 | 6.24 | 520 |
| Nitrate of soda<br>Muriate of potash<br>Soil | 1 | 1.0 : 0 | 780 | 160<br>320<br>160 | 11.04 | 780 |
| Acid phosphate<br>Muriate of potash<br>Soil | 1 | 1.0 : 0 | 180 | 320<br>160<br>160 | 5.76 | 180 |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 333 | 300<br>600<br>200 | 19.50 | 333 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 720 to 900 | 180<br>320<br>160 | 11.34 | 810 |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash<br>Sulphate of iron | 1 | 1.0 : 0 | 153 | 150<br>300<br>100<br>120 | .......... | 153 |
| Total and averages | 14 | .......... | .......... | .......... | 11.05 | 638 |

## PEANUTS.

There have been recorded the results of 34 tests of substances applied to soils for peanuts, 29 in North Carolina, and 5 in Arkansas, the results of which are given in the following table:

*Results of fertilizer tests with peanut soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 1 | 1.0 : 0 | 242 | 200 | 5.00 | 242 |
| Acid phosphate | 4 | 3.0 : 1 | −407 to 620 | 325 | 2.27 | 215 |
| Kainit | 4 | 1.0 : 1 | − 67 to 726 | 325 | 1.95 | 210 |
| Lime | 2 | 2.0 : 0 | 493 to 543 | 1,800 | 5.40 | 518 |
| Total and averages | 11 | .......... | .......... | .......... | 2.97 | 271 |

*Results of fertilizer tests with peanut soils*—Continued.

MIXTURE OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Acid phosphate<br>Kainit | 3 | 2.0 : 1 | −137 to 780 | 267<br>183 | 2.98 | 359 |
| MIXTURE OF THREE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 418 | 200<br>200<br>200 | 7.60 | 418 |
| ORGANIC FERTILIZERS—SINGLY. | | | | | | |
| Cotton-seed meal | 4 | 1.0 : 1 | −47 to 550 | 437 | 5.47 | 164 |
| ORGANIC FERTILIZERS WITH ONE MINERAL. | | | | | | |
| Cotton-seed meal<br>Acid phosphate | 3 | 2.0 : 1 | − 97 to 740 | 167<br>267 | 4.16 | 395 |
| Cotton-seed meal<br>Kainit | 3 | 0.5 : 1 | −307 to 183 | 233<br>233 | 4.32 | −61 |
| Total and averages | 6 | | | | 4.24 | 167 |
| ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS. | | | | | | |
| Cotton-seed meal<br>Acid phosphate<br>Kainit | 6 | 2.0 : 1 | −107 to 700 | 150<br>217<br>115 | 4.08 | 195 |
| MANURE. | | | | | | |
| Manure | 3 | 2.0 : 1 | −307 to 680 | 33,333 | 8.33 | 205 |

## SOY BEANS.

There have been recorded the results of 49 tests of substances applied to soils for soy beans, 44 in Connecticut and 5 in Massachusetts, the results being contained in the following table:

*Results of fertilizer tests with soy-bean soils.*

MINERALS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Nitrate of soda | 1 | 1.0 : 0 | 4.1 | 160 | 4.00 | 4.1 |
| Acid phosphate | 1 | 1.0 : 0 | 2.9 | 320 | 2.24 | 2.9 |
| Muriate of potash | 1 | 1.0 : 0 | 1.1 | 160 | 3.52 | 1.1 |
| Total and averages | 3 | | | | 3.25 | 2.7 |

*Results of fertilizer tests with soy-bean soils*—Continued.

### MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 6.1 | 160<br>320 | 6.24 | 6.1 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 3.7 | 160<br>160 | 7.52 | 3.7 |
| Acid phosphate<br>Muriate of potash | 9 | 9.0 : 0 | 1.1 to 7.6 | 320<br>160 | 5.76 | 4.9 |
| Total and averages | 11 | | | | 5.96 | 4.7 |

### MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 14 | 14.0 : 0 | 2.4 to 29.9 | 306<br>336<br>166 | 13.72 | 8.9 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | 42.8 | 290<br>500<br>480 | | 42.8 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 14 | 14.0 : 0 | 4.0 to 39.4 | 166<br>346<br>173 | 12.10 | 10.2 |
| Sulphate of ammonia<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | 33.4 | 225<br>500<br>485 | | 33.4 |
| Total and averages | 30 | | | | 12.91 | 9.5 |

### ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 12.7 | 430<br>500<br>250 | 13.60 | 12.7 |
| Dried blood<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | 20.5 | 430<br>500<br>485 | | 20.5 |
| Total and averages | 2 | | | | 13.60 | 12.7 |

### MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. Used. | Fertilizer per acre. Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Manure | 1 | 1.0 : 0 | 15.1 | 16,000 | 4.00 | 15.1 |
| Manure<br>Acid phosphate | 1 | 1.0 : 0 | 14.7 | 10,000<br>160 | 3.62 | 14.7 |
| Manure<br>Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 23.8 | 8,000<br>320<br>180 | 11.26 | 23.8 |
| Total and averages | 3 | | | | 6.29 | 17.9 |

## CLOVER AND MILLET.

There have been recorded the results of 9 tests of substances applied to soils for clover and millet as follows:

*Results of fertilizer tests on soils for clover and millet.*

MINERALS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 1 | 1.0 : 0 | 1,070 | 150 | 3.75 | 1,070 |
| Acid phosphate | 1 | 1.0 : 0 | 120 | 300 | 2.10 | 120 |
| Muriate of potash | 1 | 1.0 : 0 | 80 | 150 | 3.30 | 80 |
| Gypsum | 1 | 1.0 : 0 | 130 | 400 | 1.60 | 130 |
| Total and averages | 4 | | | | 2.69 | 350 |

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 1,270 | 150<br>350 | 6.20 | 1,270 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 1,490 | 150<br>150 | 7.05 | 1,490 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 260 | 350<br>150 | 5.75 | 260 |
| Total and averages | 3 | | | | 6.33 | 1,007 |

MIXTURE OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 2,340 | 150<br>350<br>150 | 9.50 | 2,340 |

MANURE.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Manure | 1 | 1.0 : 0 | 2,640 | 40,000 | 10.00 | 2,640 |

## CLOVER.

There have been recorded the results of 65 tests of substances applied to soils for clover in New Jersey and Delaware, the results being contained in the following table:

*Results of fertilizer tests with clover soils.*

MINERALS—SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 8 | 8.0 : 0 | 30 to 700 | 177 | 4.44 | 266 |
| Acid phosphate | 8 | 7.0 : 1 | −1,200 to 4,715 | 444 | 3.11 | 946 |
| Muriate of potash | 7 | 6.0 : 1 | − 230 to 6,600 | 153 | 3.36 | 1,676 |
| Gypsum | 5 | 4.0 : 1 | − 150 to 235 | 400 | 1.60 | 132 |
| Lime | 1 | 1.0 : 0 | 3,915 | 2,250 | 6.75 | 3,915 |
| Wood ashes | 2 | 2.0 : 0 | 1,565 to 2,125 | 100 | .25 | 1,845 |
| Total and averages | 31 | | | | 3.20 | 958 |

*Results of fertilizer tests with clover soils*—Continued.

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate | 7 | 7.0 : 0 | 520 to 4,915 | 153<br>364 | 6.37 | 2,114 |
| Nitrate of soda<br>Muriate of potash | 7 | 7.0 : 1 | −160 to 5,960 | 153<br>153 | 7.18 | 1,630 |
| Acid phosphate<br>Muriate of potash | 7 | 7.0 : 0 | 20 to 11,240 | 364<br>153 | 5.91 | 3,574 |
| Total and averages | 21 | | | | 6.49 | 2,440 |
| MIXTURE OF THREE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 7 | 7.0 : 0 | 500 to 13,640 | 153<br>364<br>153 | 9.73 | 4,247 |
| ORGANIC FERTILIZERS—SINGLY. | | | | | | |
| Guano | 1 | 1.0 : 0 | 2,085 | 1,000 | 25.00 | 2,085 |
| MANURE. | | | | | | |
| Manure | 5 | 5.0 : 0 | 2,000 to 8,215 | 40,000 | 10.00 | 4,064 |

## MILLET.

There have been recorded the results of 18 tests of substances applied to soils for millet, as follows:

*Results of fertilizer tests with millet soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 2 | 2.0 : 0 | 955 to 11,500 | 155 | 3.87 | 6,227 |
| Acid phosphate | 1 | 1.0 : 0 | 85 | 350 | 2.45 | 85 |
| Muriate of potash | 1 | 0.0 : 1 | −75 | 150 | 3.30 | −75 |
| Gypsum | 5 | 1.5 : 1 | −500 to 900 | 400 | 1.60 | 109 |
| Total and averages | 9 | | | | 2.39 | 1,454 |
| MIXTURES OF TWO MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 1,415 | 150<br>350 | 6.20 | 1,415 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 1,355 | 150<br>150 | 7.05 | 1,355 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 585 | 350<br>150 | 5.75 | 585 |
| Total and averages | 3 | | | | 6.33 | 1,118 |

*Results of fertilizer tests with millet soils*—Continued.

### MIXTURE OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 1 | 1.0 : 0 | 2,125 | 150 | 9.50 | 2,125 |
| Acid phosphate | | | | 350 | | |
| Muriate of potash | | | | 150 | | |

### ORGANIC FERTILIZER—SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Linseed-oil meal | 4 | 4.0 : 0 | 300 to 1,100 | 400 | 7.60 | 715 |

### MANURE.

| | | | | | | |
|---|---|---|---|---|---|---|
| Manure | 1 | 1.0 : 0 | 4,775 | 40,000 | 10.00 | 4,775 |

## RICE.

There have been recorded the results of 11 tests in Louisiana of substances applied to soils for rice, with the following results:

*Results of fertilizer tests with rice soils.*

### MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Sulphate of ammonia | 1 | 1.0 : 0 | 60 | 75 | 2.33 | 60 |
| Acid phosphate | 1 | 0.0 : 1 | −87 | 150 | 1.05 | −87 |
| Total and averages | 2 | | | | 1.69 | −13 |

### MIXTURE OF TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Acid phosphate | 1 | 0.0 : 1 | −130 | 150 | 1.35 | −130 |
| Kainit | | | | 50 | | |

### ORGANIC FERTILIZER—SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Cotton-seed meal | 2 | 2.0 : 0 | 12 to 131 | 250 | 3.12 | 71 |

### ORGANIC FERTILIZERS WITH ONE MINERAL.

| | | | | | | |
|---|---|---|---|---|---|---|
| Cotton-seed meal | 3 | 2.0 : 1 | −115 to 552 | 267 | 4.27 | 256 |
| Acid phosphate | | | | 123 | | |
| Dried blood | 1 | 1.0 : 0 | 211 | 75 | 1.98 | 211 |
| Ground bone | | | | 37 | | |
| Total and averages | 4 | | | | 3.93 | 245 |

*Results of fertilizer tests with rice soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Cotton-seed meal | 1 | 1.0 : 0 | 698 | 300 | 5.10 | 698 |
| Acid phosphate | | | | 150 | | |
| Kainit | | | | 50 | | |
| Cotton-seed meal | 1 | 1.0 : 0 | 345 | 100 | 3.12 | 345 |
| Nitrate of soda | | | | 25 | | |
| Fish scrap | | | | 25 | | |
| Acid phosphate | | | | 100 | | |
| Total and averages | 2 | | | | 4.05 | 521 |

## SORGHUM.

There have been recorded the results of 203 tests of substances applied to soils for sorghum, 186 in New Jersey, 9 in Kansas, and 8 in South Carolina. The results are contained in the following table:

*Results of fertilizer tests with sorghum soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 17 | 7.5 : 1 | −3,280 to 17,880 | 355 | 8.87 | 5,358 |
| Acid phosphate | 16 | 2.3 : 1 | −2,540 to 14,000 | 371 | 2.60 | 3,347 |
| Sulphate of potash | 9 | 2.0 : 1 | −5,470 to 13,300 | 181 | 5.43 | 3,462 |
| Muriate of potash | 13 | 12.0 : 1 | −2,560 to 19,170 | 150 | 3.30 | 10,185 |
| Kainit | 1 | 1.0 : 0 | 187 | 100 | .60 | 187 |
| Lime | 1 | 0.0 : 1 | −4,960 | 900 | 2.70 | −4,960 |
| Gypsum | 13 | 0.6 : 1 | −5,841 to 1,338 | 400 | 1.60 | − 242 |
| Salt | 2 | 0.0 : 2 | −3,860 to −2,680 | 1,800 | 7.20 | −3,270 |
| Total and averages | 72 | | | | 4.48 | 4,080 |

MIXTURES OF TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Nitrate of soda | 16 | 15.0 : 1 | − 40 to 17,320 | 136 | 5.62 | 5,833 |
| Acid phosphate | | | | 316 | | |
| Nitrate of soda | 13 | 3.3 : 1 | −4,310 to 14,800 | 138 | 8.34 | 6,405 |
| Sulphate of potash | | | | 155 | | |
| Nitrate of soda | 13 | 13.0 : 0 | 1,048 to 24,040 | 137 | 6.75 | 11,853 |
| Muriate of potash | | | | 150 | | |
| Nitrate of soda | 1 | 1.0 : 0 | 2,712 | 100 | 3.10 | 2,712 |
| Kainit | | | | 100 | | |
| Acid phosphate | 13 | 2.2 : 1 | −6,460 to 13,810 | 315 | 7.12 | 4,952 |
| Sulphate of potash | | | | 160 | | |
| Acid phosphate | 8 | 8.0 : 0 | 298 to 19,480 | 315 | 5.53 | 7,952 |
| Muriate of potash | | | | 150 | | |
| Acid phosphate | 1 | 0.0 : 1 | −937 | 300 | 2.70 | −937 |
| Kainit | | | | 100 | | |
| Total and averages | 65 | | | | 6.60 | 7,084 |

*Results of fertilizer tests with sorghum soils*—Continued.

### MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 23 | 10.5 : 1 | −4,203 to 21,087 | 138 | 11.76 | 6,722 |
| Acid phoshpate | | | | 486 | | |
| Sulphate of potash | | | | 164 | | |
| Nitrate or soda | 15 | 14.0 : 1 | −8,302 to 19,580 | 358 | 16.50 | 7,340 |
| Acid phosphate | | | | 451 | | |
| Muriate of potash | | | | 200 | | |
| Nitrate of soda | 1 | 1.0 : 0 | 2,437 | 100 | 5.20 | 2,437 |
| Acid phosphate | | | | 300 | | |
| Kainit | | | | 100 | | |
| Total and averages | 39 | | | | 13.42 | 6,850 |

### ORGANIC FERTILIZERS SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Boneblack | 1 | 0.0 : 1 | −1,610 | 315 | 3.46 | −1,610 |

### ORGANIC FERTILIZERS WITH ONE MINERAL.

| | | | | | | |
|---|---|---|---|---|---|---|
| Boneblack | 2 | 2.0 : 0 | 2,230 to 2,490 | 315 | 6.89 | 2,360 |
| Nitrate of soda | | | | 137 | | |
| Boneblack | 2 | 0.0 : 2 | −6,460 to −2,380 | 315 | 8.27 | −4,420 |
| Sulphate of potash | | | | 160 | | |
| Total and averages | 4 | | | | 7.58 | −1,030 |

### ORGANIC FERTILIZERS WITH TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Boneblack | 7 | 6.0 : 1 | −1,770 to 14,010 | 495 | 13.67 | 4,844 |
| Nitrate of soda | | | | 137 | | |
| Sulphate of potash | | | | 160 | | |
| Boneblack | 3 | 2.0 : 1 | 90 to 7,630 | 538 | 23.65 | 3,527 |
| Nitrate of soda | | | | 504 | | |
| Muriate of potash | | | | 233 | | |
| Total and averages | 10 | | | | 16.66 | 4,449 |

### MANURE.

| | | | | | | |
|---|---|---|---|---|---|---|
| Manure | 11 | 10.0 : 1 | −90 to 29,997 | 40,000 | 10.00 | 11,465 |

### COMMERCIAL FERTILIZERS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 1 | 1.0 : 0 | 1,080 | 1,400 | 14.00 | 1,080 |

## COWPEAS (HAY).

There have been recorded the results of 105 tests of substances applied to soils for cowpea-vine hay. These have been distributed as follows: 53 in Georgia, 21 in Delaware, 14 in Arkansas, 8 in Mississippi, 8 in Tennessee, and 1 in New Jersey. The results are embodied in the following table:

*Results of fertilizer tests with cowpea soils.*

### MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 9 | 8.0 : 1 | 0 to 1,700 | 118 | 2.94 | 697 |
| Acid phosphate | 19 | 8.5 : 1 | −800 to 3,560 | 284 | 1.98 | 1,563 |
| Rock phosphate | 6 | 2.0 : 1 | −1,552 to 762 | 400 | 1.80 | −15 |
| Muriate of potash | 10 | 4.0 : 1 | −299 to 1,912 | 96 | 2.12 | 595 |
| Kainit | 8 | 8.0 : 0 | 42 to 3,140 | 161 | .97 | 1,200 |
| Floats | 2 | 2.0 : 0 | 605 to 676 | 133 | .53 | 600 |
| Basic slag | 3 | 3.0 : 0 | 81 to 1,634 | 116 | .72 | 1,084 |
| Gypsum | 4 | 4.0 : 0 | 522 to 1,345 | 137 | .54 | 974 |
| Total and averages | 61 | | | | 1.79 | 981 |

### MIXTURES OF TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate | 6 | 5.0 : 1 | −600 to 5,300 | 98<br>240 | 4.14 | 2,035 |
| Nitrate of soda<br>Muriate of potash | 7 | 7.0 : 0 | 774 to 2,240 | 107<br>100 | 4.88 | 1,323 |
| Acid phosphate<br>Muriate of potash | 12 | 12.0 : 0 | 200 to 4,820 | 317<br>138 | 5.26 | 1,846 |
| Rock phosphate<br>Muriate of potash | 3 | 0.5 : 1 | −1,483 to 649 | 320<br>187 | 5.55 | 368 |
| Acid phophate<br>Kainit | 5 | 5.0 : 0 | 63 to 5,300 | 105<br>105 | 1.36 | 1,885 |
| Kainit<br>Gypsum | 1 | 1.0 : 0 | 1,604 | 100<br>100 | 1.00 | 1,604 |
| Total and averages | 34 | | | | 4.31 | 1,575 |

### MIXTURE OF THREE MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 9 | 9.0 : 0 | 965 to 5,360 | 101<br>316<br>122 | 7.43 | 2,103 |

### ORGANIC FERTILIZERS WITH TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 934 | 225<br>500<br>200 | 10.81 | 934 |

## COWPEAS (SEED).

There have been recorded the results of 146 tests of substances applied to soils for cowpea seed. These tests are distributed as follows: Georgia, 75; Maine, 27; Tennessee, 16; Arkansas, 14; Delaware, 7; and Maryland, 7. The results are embodied in the following table:

*Results of fertilizer tests with cowpea soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Nitrate of soda | 9 | 0.5 : 1 | −6.5 to 6.2 | 194 | 4.86 | 0.9 |
| Acid phosphate | 18 | 5.0 : 1 | −1.3 to 11.1 | 426 | 2.98 | 2.7 |
| Rock phosphate | 5 | 5.0 : 0 | .4 to 2.7 | 448 | 2.02 | 1.2 |
| Muriate of potash | 8 | 3.0 : 1 | −1.8 to 12.9 | 185 | 4.07 | 3.1 |
| Kainit | 4 | 0.3 : 1 | 2.6 to 3.2 | 960 | 5.76 | − .7 |
| Total and averages | 44 | | | | 3.71 | 1.9 |
| MIXTURES OF TWO MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate | 7 | 1.3 : 1 | −2.8 to 4.1 | 100<br>434 | 5.54 | 0.6 |
| Nitrate of soda<br>Rock phosphate | 2 | 1.0 : 1 | −1.3 to 0.6 | 80<br>480 | 4.16 | − .4 |
| Nitrate of soda<br>Muriate of potash | 3 | 3.0 : 0 | 5.1 to 8.6 | 103<br>87 | 4.49 | 7.4 |
| Nitrate of soda<br>Kainit | 1 | 0.0 : 1 | −0.3 | 160<br>1,280 | 11.68 | − .3 |
| Sulphate of ammonia<br>Muriate of potash | 2 | 2.0 : 0 | 0.4 to 1.2 | 200<br>100 | 8.40 | .8 |
| Acid phosphate<br>Muriate of potash | 20 | 3.0 : 1 | 1.3 to 13.7 | 394<br>157 | 6.22 | 3.3 |
| Acid phosphate<br>Kainit | 7 | 0.7 : 1 | −2.2 to 3.4 | 411<br>1,097 | 9.46 | .2 |
| Rock phosphate<br>Muriate of potash | 5 | 0.7 : 1 | −1.4 to 1.1 | 448<br>208 | 6.59 | − .1 |
| Muriate of potash<br>Gypsum | 1 | 0.0 : 1 | 0 | 50<br>300 | 2.30 | 0 |
| Total and averages | 48 | | | | 6.55 | 2.0 |
| MIXTURES OF THREE OR MORE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 8 | 3.0 : 1 | −5.2 to 9.4 | 391<br>525<br>212 | 18.11 | 2.7 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 4 | 1.0 : 1 | − .4 to 2.4 | 100<br>400<br>960 | 11.06 | .8 |
| Nitrate of soda<br>Rock phosphate<br>Muriate of potash | 1 | 1.0 : 0 | .5 | 80<br>640<br>80 | 6.64 | .5 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 9 | 8.0 : 1 | − .7 to 3.2 | 138<br>344<br>100 | 8.94 | 1.5 |
| Sulphate of ammonia<br>Rock phosphate<br>Muriate of potash | 2 | 1.0 : 1 | − .4 to 2.0 | 200<br>300<br>100 | 9.75 | .8 |

*Results of fertilizer tests with cowpea soils*—Continued.

MIXTURES OF THREE OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Rock phosphate<br>Muriate of potash<br>Gypsum | 2 | 1.0 : 1 | 0 to .5 | 375<br>50<br>300 | 3.98 | 0.2 |
| Nitrate of soda<br>Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 2 | .0 : 2 | −1.1 to − .1 | 66<br>16<br>500<br>100 | 7.84 | − .6 |
| Nitrate of soda<br>Rock phosphate<br>Sulphate of potash<br>Muriate of potash | 2 | 1.0 : 1 | − .9 to 1.9 | 66<br>1,000<br>16<br>100 | 8.83 | .5 |
| Total and averages | 30 | | | | 11.23 | 1.4 |

ORGANIC FERTILIZERS—SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Cotton-seed meal | 6 | 0.5 : 1 | −1.2 to 1.7 | 463 | 6.75 | 0.1 |

ORGANIC FERTILIZERS WITH ONE MINERAL.

| | | | | | | |
|---|---|---|---|---|---|---|
| Cotton-seed meal<br>Acid phosphate | 3 | 3.0 : 0 | 0.4 to 4.3 | 240<br>640 | 7.48 | 2.2 |
| Cotton-seed meal<br>Rock phosphate | 2 | .0 : 2 | .6 to .1 | 180<br>480 | 4.41 | .3 |
| Total and averages | 5 | | | | 6.25 | 1.5 |

ORGANIC FERTILIZERS WITH TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Dried blood<br>Ground bone<br>Wood ashes | 2 | 1.0 : 1 | −8.4 to 2.0 | 2,000<br>600<br>4,000 | 57.80 | −3.2 |
| Ground bone<br>Sulphate of ammonia<br>Muriate of potash | 2 | 2.0 : 0 | .8 to 3.4 | 360<br>170<br>100 | 12.15 | 2.1 |
| Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 5.5 | 225<br>500<br>200 | 10.71 | 5.5 |
| Cotton-seed meal<br>Acid phosphate<br>Kainit | 1 | .0 : 1 | − .4 | 360<br>640<br>1,280 | 16.66 | − .4 |
| Total and averages | 6 | | | | 27.88 | .5 |

MANURE.

| | | | | | | |
|---|---|---|---|---|---|---|
| Manure | 7 | 7.0 : 0 | 1.0 to 16.1 | 40,000 | 10.00 | 8.1 |

## ALFALFA.

There have been recorded the results of 42 tests of substances applied to soils for alfalfa in Ohio as follows:

*Results of fertilizer tests with alfalfa soils.*

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| MIXTURE OF TWO MINERALS. | | | | | | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Acid phosphate<br>Lime | 4 | 4 : 0 | 1,173 to 3,134 | 320<br>10,375 | 33.36 | 2,036 |
| MIXTURES OF THREE OR MORE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Lime | 3 | 2.0 : 1 | −431 to 770 | 80<br>320<br>9,500 | 32.74 | 283 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash<br>Lime | 5 | 1.5 : 1 | −647 to 1,914 | 80<br>320<br>60<br>9,160 | 33.04 | 431 |
| Nitrate of soda<br>Acid phosphate<br>Lime<br>Inoculated soil | 4 | 3.0 : 1 | −854 to 1,828 | 80<br>320<br>3,400<br>195 | 14.44 | 792 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash<br>Lime<br>Inoculated soil | 2 | 2.0 : 0 | 1,142 to 1,555 | 80<br>320<br>60<br>2,500<br>195 | 13.06 | 1,348 |
| Acid phosphate<br>Lime<br>Inoculated soil | 4 | 4.0 : 0 | 70 to 2,067 | 320<br>3,400<br>195 | 12.44 | 782 |
| Acid phosphate<br>Muriate of potash<br>Lime | 2 | 2.0 : 0 | 1,436 to 2,593 | 320<br>60<br>7,750 | 26.81 | 2,014 |
| Acid phosphate<br>Muriate of potash<br>Lime<br>Inoculated soil | 4 | 4.0 : 0 | 721 to 1,656 | 320<br>60<br>2,950<br>195 | 12.41 | 1,238 |
| Total and averages | 24 | | | | 20.85 | 874 |
| MANURE AND COMBINATIONS. | | | | | | |
| Manure<br>Lime | 4 | 3.0 : 1 | − 69 to 711 | 14,000<br>10,125 | 34.62 | 284 |
| Manure<br>Acid phosphate<br>Lime | 3 | 2.0 : 1 | −353 to 2,172 | 8,000<br>160<br>17,833 | 56.29 | 930 |
| Manure<br>Lime<br>Inoculated soil | 4 | 3.0 : 1 | −907 to 2,235 | 16,000<br>3,400<br>195 | 14.20 | 1,014 |
| Manure<br>Acid phosphate<br>Lime<br>Inoculated soil | 3 | 2.0 : 1 | −814 to 748 | 8,000<br>160<br>3,133<br>195 | 12.52 | 220 |
| Total and averages | 14 | | | | 28.05 | 617 |

## BARLEY.

There have been recorded the results of 53 tests of substances applied to soils for barley, distributed as follows: Twenty-three in Maine, 16 in Wisconsin, 4 in Indiana, 4 in Louisiana, 3 in Kansas, 2 in New Jersey, and 1 in Montana. The results are incorporated in the following table:

*Results of fertilizer tests with barley soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Nitrate of soda | 5 | 4.0 : 1 | −13 to 48 | 157 | 3.91 | 22.0 |
| Sulphate of ammonia | 1 | .0 : 1 | − 5 | 200 | 6.20 | − 5.0 |
| Acid phosphate | 5 | 4.0 : 1 | − 9 to 10 | 355 | 2.48 | 2.0 |
| Sulphate of potash | 1 | .0 : 1 | −10 | 125 | 3.75 | −10.0 |
| Muriate of potash | 2 | 2.0 : 0 | 2 to 9 | 150 | 3.30 | 6.0 |
| Wood ashes | 4 | 4.0 : 0 | 11 to 29 | 1,844 | 4.61 | 2.0 |
| Total and averages | 18 | | | | 3.72 | 6.4 |
| **MIXTURES OF TWO MINERALS.** | | | | | | |
| Muriate of soda<br>Acid phosphate | 2 | 2.0 : 0 | 4 to 14 | 145<br>400 | 6.43 | 9.0 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 6 | 150<br>100 | 5.95 | 6.0 |
| Acid sulphate<br>Muriate of potash | 5 | 4.0 : 1 | 0 to 17 | 425<br>100 | 5.14 | 7.0 |
| Acid phosphate<br>Wood ashes | 3 | 3.0 : 0 | 27 to 35 | 200<br>1,400 | 4.90 | 30.0 |
| Total and averages | 11 | | | | 5.38 | 13.5 |
| **MIXTURES OF THREE OR MORE MINERALS.** | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 20 | 150<br>500<br>100 | 9.45 | 20 |
| Sulphate of ammonia<br>Acid phosphate<br>Muriate of potash | 3 | 3.0 : 0 | 7 to 10 | 165<br>210<br>67 | 8.07 | 8 |
| Acid phosphate<br>Muriate of potash<br>Lime | 3 | 3.0 : 0 | 19 to 24 | 300<br>50<br>1,600 | 8.00 | 21 |
| Nitrate of soda<br>Sulphate of ammonia<br>Rock phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 5 | 66<br>16<br>1,000<br>100 | 8.85 | 5 |
| Nitrate of soda<br>Sulphate of ammonia<br>Nitrate of potash<br>Acid phosphate | 1 | 1.0 : 0 | 5 | 66<br>16<br>100<br>500 | 8.15 | 5 |
| Total and averages | 9 | | | | 8.29 | 13 |
| **ORGANIC FERTILIZERS—SINGLY.** | | | | | | |
| Ground bone | 2 | 2.0 : 0 | 2.4 to 5.3 | 450 | 5.85 | 4 |

*Results of fertilizer tests with barley soils*—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. |  | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
| ORGANIC FERTILIZERS WITH ONE MINERAL. |  |  |  |  |  |  |
|  |  | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Cotton-seed meal<br>Acid phosphate | 4 | 4.0 : 0 | 3 to 21 | 200<br>100 | 3.20 | 10 |
| MANURE. |  |  |  |  |  |  |
| Manure | 7 | 7.0 : 0 | 0.4 to 39 | 17,381 | 4.35 | 18 |
| COMMERCIAL FERTILIZERS. |  |  |  |  |  |  |
| Commercial fertilizers | 2 | 2.0 : 0 | 5.7 to 14.5 | 500 | 5.00 | 10 |

## MANGEL WURZELS.

The results have been recorded of 7 tests of substances applied to soils for Mangel wurzels as follows:

*Results of fertilizer tests on soils used for Mangel wurzels.*

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. |  | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
| MINERALS SINGLY. |  |  |  |  |  |  |
|  |  | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 1 | 0.0 : 1 | −4,796 | 160 | 4.00 | −4,796 |
| Acid phosphate | 1 | 0.0 : 1 | −2,722 | 400 | 2.80 | −2,722 |
| Muriate of potash | 1 | 1.0 : 0 | 540 | 160 | 3.52 | 540 |
| Total and averages | 3 | .......... | .................... | .......... | 3.44 | −2,326 |
| MIXTURE OF TWO MINERALS. |  |  |  |  |  |  |
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 16,783 | 160<br>400 | 6.80 | 16,783 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 24,159 | 160<br>160 | 7.52 | 24,159 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 19,111 | 400<br>160 | 6.32 | 19,111 |
| Total and averages | 3 | .......... | .................... | .......... | 6.88 | 20,018 |
| MIXTURES OF THREE MINERALS. |  |  |  |  |  |  |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 23,813 | 160<br>400<br>160 | 10.32 | 23,813 |

## TEOSINTE.

The results have been recorded of 7 tests made in Delaware on soils used for teosinte as follows:

*Results of fertilizer tests on soils used for teosinte.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 2 | 1.0 : 1 | −3,018 to 216 | 160 | 4.00 | −1,401 |
| Acid phosphate | 1 | 1.0 : 0 | 4,774 | 400 | 2.80 | 4,774 |
| Muriate of potash | 1 | 1.0 : 0 | 4,327 | 160 | 3.52 | 4,327 |
| Total and averages | 4 | ......... | ......... | ......... | 3.58 | 1.925 |

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 15,876 | 160<br>160 | 7.52 | 15,876 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 17,541 | 400<br>160 | 6.32 | 17,541 |
| Total and averages | 2 | ......... | ......... | ......... | 6.92 | 16,708 |

MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 20,959 | 160<br>400<br>160 | 10.32 | 20,959 |

## SALT GRASS.

The results of 4 tests in New Jersey on soils for salt-grass hay are as follows:

*Results of fertilizer tests on soils used for salt grass.*

MINERAL SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 1 | 0.0 : 1 | −60 | 160 | 4.00 | −60 |

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 100 | 160<br>320 | 6.24 | 100 |
| Nitrate of soda<br>Muriate of potash | 1 | 0.0 : 1 | −260 | 160<br>160 | 7.52 | −260 |
| Total and averages | 2 | ......... | ......... | ......... | 6.88 | −80 |

MIXTURE OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 1 | 0.0 : 1 | −240 | 160<br>320<br>160 | 9.76 | −240 |

## FERTILIZERS ON SOILS USED FOR VARIOUS TRUCK CROPS.

### SWEET POTATOES.

There have been recorded the results of 367 tests of substances applied to soils for sweet potatoes distributed as follows: Ninety-six in New Jersey, 81 in Georgia, 33 in Delaware, 32 in Maryland, 29 in Louisiana, 25 in Texas, 21 in Tennessee, 20 in Mississippi, 18 in North Carolina, 8 in Colorado, and 4 in Alabama. The results are embodied in the following table:

*Results of fertilizer tests on sweet-potato soils.*

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Nitrate of soda | 14 | 1.8 : 1 | −69 to 69 | 204 | 5.11 | 12 |
| Acid phosphate | 20 | 4.0 : 1 | −49 to 287 | 418 | 2.93 | 42 |
| Rock phosphate | 1 | 1.0 : 0 | 2 | 500 | 2.25 | 2 |
| Basic slag | 2 | 0.0 : 2 | − 7 to −3 | 315 | 1.95 | − 5 |
| Sulphate of potash | 4 | 4.0 : 0 | 12 to 125 | 150 | 4.50 | 61 |
| Muriate of potash | 12 | 11.0 : 1 | −51 to 87 | 158 | 3.48 | 34 |
| Kainit | 3 | 3.0 : 0 | 1 to 85 | 267 | 1.60 | 34 |
| Boneblack | 1 | 1.0 : 0 | 10 | 300 | 3.30 | 10 |
| Cotton-hull ashes | 4 | 3.0 : 1 | − 1 to 59 | 511 | 8.69 | 34 |
| Lime | 1 | 1.0 : 0 | 53 | 4,360 | 13.08 | 53 |
| Marl | 1 | 0.0 : 1 | −14 | 8,000 | 2.00 | −14 |
| Gypsum | 4 | 0.0 : 4 | −21 to 0 | 342 | 1.37 | − 9 |
| Total and averages | 67 | | | | 3.87 | 26 |
| MIXTURES OF TWO MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate | 8 | 7.0 : 1 | −13 to 87 | 174<br>388 | 7.06 | 37 |
| Nitrate of soda<br>Sulphate of potash | 1 | 0.0 : 1 | −30 | 460<br>200 | 17.50 | −30 |
| Nitrate of soda<br>Muriate of potash | 10 | 9.0 : 1 | −26 to 64 | 189<br>141 | 7.82 | 43 |
| Nitrate of soda<br>Kainit | 1 | 1.0 : 0 | 13 | 200<br>400 | 7.40 | 13 |
| Nitrate of soda<br>Boneblack | 1 | 1.0 : 0 | 12 | 460<br>300 | 14.80 | 12 |
| Acid phosphate<br>Sulphate of potash | 2 | 1.0 : 1 | 0 to 298 | 300<br>100 | 5.10 | 149 |
| Acid phosphate<br>Muriate of potash | 13 | 13.0 : 0 | 26 to 99 | 363<br>140 | 5.62 | 62 |
| Acid phosphate<br>Kainit | 3 | 3.0 : 0 | 23 to 133 | 283<br>250 | 3.48 | 60 |
| Acid phosphate<br>Gypsum | 2 | 1.0 : 1 | − 1 to 9 | 40<br>40 | .44 | 4 |
| Sulphate of potash<br>Boneblack | 3 | 3.0 : 0 | 58 to 83 | 173<br>313 | 8.65 | 72 |
| Muriate of potash<br>Boneblack | 10 | 10.0 : 0 | 13 to 83 | 160<br>320 | 7.04 | 54 |
| Kainit<br>Boneblack | 2 | 2.0 : 0 | 12 to 47 | 640<br>320 | 7.36 | 29 |
| Total and averages | 56 | | | | 6.79 | 51 |

*Results of fertilizer tests on sweet-potato soils*—Continued.

MIXTURES OF THREE OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 2 | 2.0 : 0 | 17 to 77 | 285<br>400<br>170 | 15.02 | 47 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 41 | 41.0 : 0 | 39 to 135 | 305<br>497<br>174 | 14.92 | 76 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 5 | 5.0 : 0 | 50 to 133 | 185<br>370<br>435 | 9.83 | 89 |
| Nitrate of soda<br>Sulphate of potash<br>Boneblack | 3 | 2.0 : 1 | −24 to 74 | 287<br>173<br>313 | 15.81 | 36 |
| Nitrate of soda<br>Muriate of potash<br>Boneblack | 14 | 13.0 : 1 | − 6 to 113 | 229<br>183<br>366 | 13.73 | 63 |
| Nitrate of soda<br>Kainit<br>Boneblack | 2 | 1.0 : 1 | −10 to 35 | 200<br>640<br>320 | 12.36 | 13 |
| Nitrate of soda<br>Muriate of potash<br>Rock phosphate | 3 | 3.0 : 0 | 99 to 140 | 211<br>135<br>364 | 9.87 | 120 |
| Nitrate of soda<br>Kainit<br>Rock phosphate | 2 | 2.0 : 0 | 82 to 142 | 158<br>487<br>364 | 8.51 | 112 |
| Nitrate of soda<br>Acid phosphate<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 48 | 250<br>400<br>160 | ........ | 48 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | ................ | 250<br>400<br>160 | ........ | 55 |
| Total and averages | 74 | ........ | ................ | ........ | 13.64 | 73 |

ORGANIC FERTILIZERS SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Ground bone | 3 | 0.5 : 1 | − 9 to 40 | 467 | 6.07 | 10 |
| Cotton seed | 2 | 2.0 : 0 | 2 to 17 | 1,350 | 10.80 | 9 |
| Cotton-seed meal | 14 | 3.7 : 1 | −18 to 296 | 600 | 7.50 | 45 |
| Total and averages | 19 | ........ | ................ | ........ | 7.62 | 36 |

ORGANIC FERTILIZERS WITH ONE MINERAL.

| | | | | | | |
|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate | 1 | 0.0 : 1 | −30 | 260<br>400 | 8.00 | −30 |
| Dried blood<br>Muriate of potash | 1 | 1.0 : 0 | 17 | 264<br>200 | 9.72 | 17 |
| Ground bone<br>Nitrate of soda | 1 | 0.0 : 1 | − 1 | 200<br>150 | 6.35 | − 1 |
| Cotton-seed meal<br>Acid phosphate | 13 | 13.0 : 0 | 14 to 243 | 385<br>241 | 6.50 | 103 |
| Cotton-seed meal<br>Sulphate of potash | 2 | 2.0 : 0 | 43 to 320 | 1,000<br>100 | 15.50 | 181 |
| Cotton-seed meal<br>Muriate of potash | 2 | 2.0 : 0 | 33 to 79 | 225<br>75 | 4.46 | 56 |
| Total and averages | 20 | ........ | ................ | ........ | 7.42 | 90 |

*Results of fertilizer tests on sweet-potato soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Dried blood | 1 | 0.0 : 1 | − 9 | 150 | 8.91 | − 9 |
| Acid phosphate | | | | 330 | | |
| Sulphate of potash | | | | 120 | | |
| Dried blood | 1 | 1.0 : 0 | 40 | 264 | 12.48 | 40 |
| Acid phosphate | | | | 400 | | |
| Muriate of potash | | | | 200 | | |
| Dried blood | 2 | 2.0 : 0 | 56 to 79 | 280 | 13.92 | 67 |
| Boneblack | | | | 320 | | |
| Sulphate of potash | | | | 160 | | |
| Dried blood | 14 | 13.0 : 1 | − 6 to 138 | 320 | 14.45 | 50 |
| Boneblack | | | | 366 | | |
| Muriate of potash | | | | 183 | | |
| Dried blood | 2 | 2.0 : 0 | 16 to 47 | 280 | 12.96 | 31 |
| Boneblack | | | | 320 | | |
| Kainit | | | | 640 | | |
| Dried fish | 3 | 3.0 : 0 | 14 to 68 | 405 | 13.49 | 38 |
| Nitrate of soda | | | | 92 | | |
| Sulphate of potash | | | | 103 | | |
| Dried fish | 4 | 4.0 : 0 | 19 to 149 | 232 | 10.08 | 76 |
| Acid phosphate | | | | 232 | | |
| Sulphate of potash | | | | 128 | | |
| Cotton-seed meal | 1 | 0.0 : 1 | −11 | 320 | 10.88 | − 11 |
| Ground bone | | | | 320 | | |
| Cotton-hull ashes | | | | 160 | | |
| Cotton-seed meal | 2 | 2.0 : 0 | 71 to 321 | 1,000 | 17.60 | 196 |
| Acid phosphate | | | | 300 | | |
| Sulphate of potash | | | | 100 | | |
| Cotton-seed meal | 31 | 31.0 : 0 | 12 to 271 | 387 | 10.44 | 105 |
| Acid phosphate | | | | 352 | | |
| Muriate of potash | | | | 143 | | |
| Cotton-seed meal | 17 | 17.0 : 0 | 1 to 203 | 329 | 9.57 | 76 |
| Acid phosphate | | | | 313 | | |
| Kainit | | | | 544 | | |
| Cotton-seed meal | 2 | 2.0 : 0 | 9 to 10 | 240 | 6.89 | 9 |
| Acid phosphate | | | | 240 | | |
| Cotton-hull ashes | | | | 130 | | |
| Cotton-seed meal | 4 | 4.0 : 0 | 93 to 142 | 142 | 13.11 | 115 |
| Rock phosphate | | | | 455 | | |
| Muriate of potash | | | | 422 | | |
| Cotton-seed meal | 2 | 2.0 : 0 | 119 to 127 | 338 | 8.79 | 123 |
| Rock phosphate | | | | 364 | | |
| Kainit | | | | 487 | | |
| Dried blood | 2 | 0.0 : 2 | − 2 to −1 | 50 | ........ | − 2 |
| Ground bone | | | | 250 | | |
| Nitrate of soda | | | | 75 | | |
| Sulphate of potash | | | | 50 | | |
| Carbonate of potash | | | | 75 | | |
| Total and averages | 88 | ........ | ........ | ........ | 11.33 | 81 |

*Results of fertilizer tests on sweet-potato soils*—Continued.

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Manure | 27 | 12.5 : 1 | — 3 to 226 | 11,485 | 2.87 | 66 |
| Manure<br>Nitrate of soda | 1 | 0.0 : 1 | 0 | 30,000<br>150 | 11.25 | 0 |
| Manure<br>Acid phosphate | 1 | 1.0 : 0 | 69 | 30,000<br>300 | 9.60 | 69 |
| Manure<br>Nitrate of soda<br>Boneblack<br>Sulphate of potash | 2 | 2.0 : 0 | 95 to 138 | 20,000<br>100<br>160<br>80 | 11.66 | 117 |
| Manure<br>Nitrate of soda<br>Boneblack<br>Muriate of potash | 8 | 3.0 : 1 | — 7 to 137 | 8,625<br>150<br>240<br>120 | 11.19 | 48 |
| Total and averages | 39 | | | | 5.42 | 63 |

COMMERCIAL FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 4 | 0.3 : 1 | —108 to 25 | 315 | 3.15 | —40 |

## TOMATOES.

There have been recorded the results of 179 tests on soils for tomatoes distributed as follows: 91 in New Jersey, 53 in Maryland, 14 in Indiana, 14 in Texas, and 7 in Mississippi. These results are embodied in the following table:

*Results of fertilizer tests on tomato soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 40 | 5.7 : 1 | —2,170 to 14,034 | 234 | 5.86 | 5,954 |
| Sulphate of ammonia | 1 | 1.0 : 0 | 13,490 | 120 | 3.72 | 13,490 |
| Acid phosphate | 8 | 3.0 : 1 | — 580 to 7,360 | 407 | 2.85 | 2,695 |
| Rock phosphate | 1 | 0.0 : 1 | — 1,680 | 500 | 2.25 | —1,680 |
| Sulphate of potash | 1 | 0.0 : 1 | — 960 | 200 | 6.00 | — 960 |
| Muriate of potash | 5 | 4.0 : 1 | —1,032 to 3,180 | 196 | 4.31 | 1,200 |
| Basic slag | 1 | 1.0 : 0 | 1,920 | 230 | 1.43 | 1,920 |
| Cotton-seed hull ashes | 1 | 1.0 : 0 | 6,160 | 470 | 7.99 | 6,160 |
| Gypsum | 1 | 0.0 : 1 | — 1,520 | 570 | 2.28 | —1,520 |
| Wood ashes | 1 | 0.0 : 1 | — 406 | 2,000 | 5.00 | — 406 |
| Castor pumice | 1 | 0.0 : 1 | — 1,120 | 588 | 6.76 | —1,120 |
| Lime | 2 | 1.0 : 1 | — 492 to 1,200 | 2,000 | 6.00 | 354 |
| Marl | 1 | 1.0 : 0 | 640 | 8,000 | 2.00 | 640 |
| Total and averages | 64 | | | | 5.13 | 4,421 |

*Results of fertilizer tests on tomato soils*—Continued.

### MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate | 5 | 5.0 : 0 | 1,534 to 3,240 | 160<br>448 | 7.14 | 2,526 |
| Nitrate of soda<br>Muriate of potash | 7 | 7.0 : 0 | 1,760 to 4,260 | 160<br>228 | 9.03 | 3,023 |
| Acid phosphate<br>Muriate of potash | 11 | 10.0 : 1 | −1,190 to 5,820 | 296<br>189 | 6.23 | 3,249 |
| Total and averages | 23 | ......... | .................. | ......... | 7.28 | 3,023 |

### MIXTURE OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 29 | 13.5 : 1 | −550 to 12,380 | 234<br>332<br>161 | 11.70 | 5,644 |

### ORGANIC FERTILIZERS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood | 6 | 6.0 : 0 | 280 to 7,004 | 237 | 4.74 | 1,985 |
| Dried fish | 1 | 1.0 : 0 | 1,760 | 404 | 8.08 | 1,760 |
| Tankage | 1 | 1.0 : 0 | 3,048 | 500 | 6.50 | 3,048 |
| Cotton-seed meal | 1 | 1.0 : 0 | 2.901 | 500 | 6.25 | 2,901 |
| Azotin | 2 | 2.0 : 0 | 1,220 to 1,300 | 260 | ......... | 1,260 |
| Total and averages | 11 | ......... | .................. | ......... | 5.48 | 2,179 |

### ORGANIC FERTILIZERS WITH ONE MINERAL.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate | 1 | 1.0 : 0 | 4,240 | 264<br>400 | 8.08 | 4,240 |
| Dried blood<br>Muriate of potash | 1 | 1.0 : 0 | 1,280 | 264<br>200 | 9.68 | 1,280 |
| Boneblack<br>Nitrate of soda | 1 | 1.0 : 0 | 4,676 | 320<br>160 | 7.52 | 4,676 |
| Boneblack<br>Muriate of potash | 3 | 3.0 : 0 | 2,889 to 13,194 | 320<br>160 | 7.04 | 6,772 |
| Cotton-seed meal<br>Wood ashes | 1 | 1.0 : 0 | 2,102 | 500<br>2,000 | 11.25 | 2,102 |
| Total and averages | 7 | ......... | .................. | ......... | 8.24 | 4,659 |

### ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 6,480 | 264<br>400<br>200 | 12.48 | 6,480 |
| Boneblack<br>Nitrate of soda<br>Muriate of potash | 12 | 12.0 : 0 | 3,655 to 16,150 | 320<br>240<br>160 | 13.04 | 9,666 |
| Cotton-seed meal<br>Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 7,320 | 105<br>54<br>245 | 4.37 | 7,320 |
| Cotton-seed meal<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 4,528 | 500<br>300<br>300 | 14.95 | 4,528 |
| Cotton-seed meal<br>Nitrate of soda<br>Acid phosphate<br>Kainit | 5 | 5.0 : 0 | 2,920 to 6,660 | 106<br>58<br>263<br>83 | 5.11 | 5,050 |

*Results of fertilizer tests on tomato soils*—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Cotton-seed meal | 1 | 1.0 : 0 | 2,930 | 105 | 8.01 | 2,930 |
| Nitrate of soda | | | | 54 | | |
| Acid phosphate | | | | 245 | | |
| Kainit | | | | 105 | | |
| Lime | | | | 1,000 | | |
| Azotin | 2 | 2.0 : 0 | 1,980 to 9,620 | 120 | | 5,800 |
| Nitrate of soda | | | | 200 | | |
| Acid phosphate | | | | 200 | | |
| Azotin | 2 | 2.0 : 0 | 2,780 to 4,160 | 120 | | 3,470 |
| Nitrate of soda | | | | 200 | | |
| Muriate of potash | | | | 250 | | |
| Azotin | 4 | 4.0 : 0 | 3,260 to 7,200 | 90 | | 5,130 |
| Nitrate of soda | | | | 150 | | |
| Acid phosphate | | | | 150 | | |
| Muriate of potash | | | | 188 | | |
| Total and averages | 29 | | | | 10.58 | 7,738 |

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Manure | 11 | 11.0 : 0 | 1,614 to 7,778 | 32,909 | 8.23 | 4,536 |
| Manure | 2 | 2.0 : 0 | 4,496 to 4,526 | 16,000 | 10.50 | 4,511 |
| Complete fertilizer | | | | 400 | | |
| Total and averages | 13 | | | | 8.83 | 4,532 |

COMMERCIAL FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 3 | 3.0 : 0 | 80 to 3,920 | 218 | 2.18 | 1,547 |

## CABBAGE.

There have been recorded the results of 82 tests of substances applied to soils for cabbage distributed as follows: 40 in Maryland, 29 in Texas, and 13 in New Jersey. The results are embodied in the following table:

*Results of fertilizer tests on cabbage soils.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 7 | 7.0 : 0 | 8,740 to 29,340 | 339 | 8.21 | 15,836 |
| Sulphate of ammonia | 3 | 3.0 : 0 | 8,560 to 9,120 | 240 | 7.44 | 8,847 |
| Acid phosphate | 2 | 1.0 : 1 | −680 to 15,210 | 700 | 4.90 | 7,265 |
| Kainit | 2 | 1.0 : 1 | −112 to 950 | 700 | 4.20 | 419 |
| Total and averages | 14 | | | | 7.00 | 10,911 |

*Results of fertilizer tests on cabbage soils*—Continued.

### MIXTURE OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. |  | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
|  |  | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 18,580 to 19,020 | 1,280<br>880<br>480 | 48.72 | 18,800 |

### ORGANIC FERTILIZERS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood | 3 | 3.0 : 0 | 5,960 to 10,860 | 393 | 7.87 | 8,973 |
| Boneblack | 1 | 1.0 : 0 | 4,648 | 700 | 7.70 | 4,648 |
| Bat guano | 1 | 1.0 : 0 | 1,430 | 1,000 | 25.00 | 1,430 |
| Cotton-seed meal | 2 | 1.0 : 1 | −2,288 to 10,210 | 800 | 10.00 | 3,961 |
| Total and averages | 7 |  |  |  | 10.90 | 5,846 |

### MIXTURES OF TWO FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Tankage<br>Muriate of potash | 2 | 2.0 : 0 | 2,450 to 7,208 | 800<br>500 | 21.40 | 4,829 |
| Tankage<br>Boneblack | 1 | 1.0 : 0 | 5,364 | 800<br>800 | 19.20 | 5,364 |
| Tankage<br>Bone meal | 1 | 1.0 : 0 | 2,610 | 800<br>800 | 20.80 | 2,610 |
| Cotton-seed meal<br>Acid phosphate | 1 | 0.0 : 1 | −4,676 | 300<br>250 | 5.50 | −4,676 |
| Bat guano<br>Nitrate of soda | 1 | 1.0 : 0 | 3,950 | 300<br>200 | 12.50 | 3,950 |
| Bat guano<br>Wood ashes | 2 | 2.0 : 0 | 5,530 to 11,400 | 800<br>3,000 | 27.50 | 8,465 |
| Bat guano<br>Cotton-seed meal | 1 | 1.0 : 0 | 9,170 | 600<br>600 | 22.50 | 9,170 |
| Total and averages | 9 |  |  |  | 15.41 | 4,778 |

### MIXTURES OF THREE FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Dried blood<br>Ground bone<br>Wood ashes | 1 | 1.0 : 0 | 15,820 | 2,000<br>600<br>4,000 | 57.80 | 15,820 |
| Dried blood<br>Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 30,030 | 186<br>348<br>112 | 8.62 | 30,030 |
| Tankage<br>Boneblack<br>Kainit | 1 | 1.0 : 0 | 10,340 | 800<br>800<br>800 | 24.00 | 10,340 |
| Tankage<br>Boneblack<br>Muriate of potash | 1 | 1.0 : 0 | 6,316 | 700<br>800<br>200 | 22.30 | 6,316 |
| Bat guano<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 13,590 to 14,758 | 400<br>400<br>300 | 19.40 | 14,174 |
| Bat guano<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 9,280 | 500<br>700<br>600 | 21.00 | 9,280 |
| Dried blood<br>Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 23 | 23.0 : 0 | 1,940 to 25,826 | 469<br>178<br>435<br>160 | 20.39 | 9,944 |
| Total and averages | 30 |  |  |  | 21.38 | 10,961 |

*Results of fertilizer tests on cabbage soils*—Continued.

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Manure | 16 | 16.0 : 0 | 3,350 to 27,443 | 26,125 | 6.53 | 11,181 |
| Manure<br>Wood ashes | 2 | 2.0 : 0 | 4,210 to 15,716 | 10,000<br>3,000 | 10.00 | 9,963 |
| Manure<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 14,640 | 10,000<br>400<br>600 | 8.90 | 14,640 |
| Total and averages | 19 | | | | 7.02 | 11,235 |

COMMERCIAL FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 1 | 1.0 : 0 | 2,230 | 800 | 8.00 | 2,230 |

## SWEET CORN.

There have been recorded the results of 59 tests of substances applied to soils for sweet corn; 27 in New Jersey, 18 in North Carolina, and 14 in Delaware, the results being contained in the following table:

*Results of fertilizer tests on soils for sweet corn.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 2 | 2.0 : 0 | 706 to 708 | 240 | 6.00 | 707 |
| Acid phosphate | 2 | 2.0 : 0 | 1,027 to 1,028 | 600 | 4.20 | 1,027 |
| Muriate of potash | 2 | 2.0 : 0 | 2,919 to 2,924 | 240 | 5.28 | 2,921 |
| Total and averages | 6 | 6.0 : 0 | | | 5.16 | 1,552 |
| | | | *Ears.* | | | *Ears.* |
| Nitrate of soda | 9 | 9.0 : 0 | 180 to 2,020 | 228 | 5.70 | 1,426 |
| Sulphate of ammonia | 9 | 9.0 : 0 | 400 to 2,480 | 182 | 5.65 | 1,691 |
| Total and averages | 18 | 18.0 : 0 | | | 5.67 | 1,558 |

MIXTURES OF TWO MINERALS.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | *Pounds.* | | | *Pounds.* |
| Nitrate of soda<br>Acid phosphate | 2 | 2.0 : 0 | 892 to 894 | 240<br>600 | 10.20 | 893 |
| Nitrate of soda<br>Muriate of potash | 2 | 2.0 : 0 | 2,307 to 2,308 | 240<br>240 | 11.28 | 2,307 |
| Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 2,627 to 2,628 | 600<br>240 | 9.48 | 2,627 |
| Total and averages | 6 | 6.0 : 0 | | | 10.32 | 1,942 |
| | | | *Ears.* | | | *Ears.* |
| Nitrate of soda<br>Acid potash | 1 | 1.0 : 0 | 4,140 | 250<br>400 | 9.05 | 4,140 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 2,680 | 250<br>160 | 9.77 | 2,680 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 1,180 | 400<br>160 | 6.32 | 1,180 |
| Total and averages | 3 | 3.0 : 0 | | | 8.38 | 2,667 |

*Results of fertilizer tests on soils for sweet corn*—Continued.

MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Ears.* | *Pounds.* | *Dollars.* | *Ears.* |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 3,040 | 250<br>400<br>160 | 13.85 | 3,040 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 11 | 11.0 : 0 | 2,560 to 4,860 | 341<br>545<br>207 | 16.90 | 3,536 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 2,200 | 250<br>400<br>160 | 10.01 | 2,200 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | 4,120 | 250<br>400<br>180 | (*a*) | 4,120 |
| Nitrate of soda<br>Acid phosphate<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 3,340 | 250<br>400<br>160 | (*a*) | 3,340 |
| Total and averages | 15 | 15.0 : 0 | | | 16.90 | 3,395 |
| | | | *Pounds.* | | | *Pounds.* |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 2 | 2.0 : 0 | 2,066 to 2,068 | 240<br>420<br>240 | 14.22 | 2,067 |

ORGANIC FERTILIZER—SINGLY.

| | | | | | | |
|---|---|---|---|---|---|---|
| Dried blood | 9 | 9.0 : 0 | *Ears.*<br>170 to 2,060 | 303 | 6.06 | *Ears.*<br>1,336 |

## TURNIPS.

There have been recorded 23 tests on soils in New Jersey for turnips as follows:

*Results of fertilizer tests on soils for turnips.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Acid phosphate | 2 | 2.0 : 0 | 116 to 137 | 297 | 2.08 | 126 |
| Floats | 1 | 1.0 : 0 | 81 | 250 | 1.00 | 81 |
| Phosphoral | 1 | 1.0 : 0 | 126 | 185 | | 126 |
| Gypsum | 1 | 1.0 : 0 | 68 | 180 | .72 | 68 |
| Total and averages | 5 | | | | 1.47 | 100 |

*Results of fertilizer tests on soils for turnips*—Continued.

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. |  | Average crop increase per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
|  |  | *Ratio.* | *Bushels.* | *Pounds.* | *Dollars.* | *Bushels.* |
| Acid phosphate | 1 | 1.0 : 0 | 123 | 255 | 2.50 | 123 |
| Gypsum |  |  |  | 180 |  |  |
| Boneblack | 1 | 1.0 : 0 | 103 | 320 | 8.32 | 103 |
| Sulphate of potash |  |  |  | 160 |  |  |
| Boneblack | 1 | 1.0 : 0 | 97 | 320 | 7.04 | 97 |
| Muriate of potash |  |  |  | 160 |  |  |
| Boneblack | 1 | 1.0 : 0 | 140 | 320 | 7.36 | 140 |
| Kainit |  |  |  | 640 |  |  |
| Floats | 1 | 1.0 : 0 | 118 | 250 | 1.72 | 118 |
| Gypsum |  |  |  | 180 |  |  |
| Gypsum | 1 | 1.0 : 0 | 124 | 180 | ........ | 124 |
| Phosphoral |  |  |  | 185 |  |  |
| Total and averages | 6 | ........ | ........ | ........ | 5.39 | 116 |
| MIXTURES OF THREE OR MORE MINERALS. |  |  |  |  |  |  |
| Nitrate of soda | 1 | 1.0 : 0 | 165 | 200 | 13.32 | 165 |
| Boneblack |  |  |  | 320 |  |  |
| Sulphate of potash |  |  |  | 160 |  |  |
| Nitrate of soda | 1 | 1.0 : 0 | 101 | 200 | 12.04 | 101 |
| Boneblack |  |  |  | 320 |  |  |
| Muriate of potash |  |  |  | 160 |  |  |
| Nitrate of soda | 1 | 1.0 : 0 | 141 | 200 | 12.36 | 141 |
| Boneblack |  |  |  | 320 |  |  |
| Kainit |  |  |  | 640 |  |  |
| Sulphate of ammonia | 1 | 1.0 : 0 | 208 | 145 | 10.43 | 208 |
| Acid phosphate |  |  |  | 340 |  |  |
| Muriate of potash |  |  |  | 100 |  |  |
| Sulphate of ammonia | 1 | 1.0 : 0 | 208 | 145 | 9.19 | 208 |
| Acid phosphate |  |  |  | 255 |  |  |
| Muriate of potash |  |  |  | 100 |  |  |
| Gypsum |  |  |  | 180 |  |  |
| Sulphate of ammonia | 1 | 1.0 : 0 | 125 | 145 | 8.41 | 125 |
| Floats |  |  |  | 250 |  |  |
| Muriate of potash |  |  |  | 100 |  |  |
| Gypsum |  |  |  | 180 |  |  |
| Sulphate of ammonia | 1 | 1.0 : 0 | 128 | 145 | ........ | 128 |
| Muriate of potash |  |  |  | 185 |  |  |
| Gypsum |  |  |  | 100 |  |  |
| Phosphoral |  |  |  | 180 |  |  |
| Total and averages | 7 | ........ | ........ | ........ | 10.96 | 158 |
| ORGANIC FERTILIZERS WITH TWO MINERALS. |  |  |  |  |  |  |
| Dried blood | 1 | 1.0 : 0 | 142 | 280 | 13.92 | 142 |
| Boneblack |  |  |  | 320 |  |  |
| Sulphate of potash |  |  |  | 160 |  |  |
| Dried blood | 1 | 1.0 : 0 | 55 | 280 | 12.64 | 55 |
| Boneblack |  |  |  | 320 |  |  |
| Muriate of potash |  |  |  | 160 |  |  |
| Dried blood | 1 | 1.0 : 0 | 206 | 280 | 12.96 | 206 |
| Boneblack |  |  |  | 320 |  |  |
| Kainit |  |  |  | 640 |  |  |
| Total and averages | 3 | ........ | ........ | ........ | 13.17 | 134 |
| MANURE AND COMBINATIONS. |  |  |  |  |  |  |
| Manure | 1 | 1.0 : 0 | 127 | 40,000 | 10.00 | 127 |
| Manure | 1 | 1.0 : 0 | 126 | 20,000 | 9.82 | 126 |
| Nitrate of soda |  |  |  | 100 |  |  |
| Boneblack |  |  |  | 160 |  |  |
| Acid phosphate |  |  |  | 80 |  |  |
| Total and averages | 2 | ........ | ........ | ........ | 9.91 | 127 |

## SNAP BEANS.

There have been recorded the results of 43 tests of substances applied to soils for snap beans, 24 in Mississippi, and 19 in North Carolina, as follows:

*Results of fertilizer tests on soils for snap beans.*

### MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 1,718 | 250<br>400 | 9.05 | 1,718 |
| Nitrate of soda<br>Muriate of potash | 1 | 1.0 : 0 | 1,504 | 250<br>160 | 9.77 | 1,504 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 786 | 400<br>160 | 6.32 | 786 |
| Total and average | 3 | | | | 8.38 | 1,336 |

### MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 1,194 | 250<br>400<br>160 | 13.85 | 1,194 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 11 | 10.0 : 1 | −56 to 2,060 | 341<br>545<br>207 | 16.90 | 1,023 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 330 | 250<br>400<br>160 | 10.01 | 330 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | 1,770 | 250<br>400<br>160 | | 1,770 |
| Nitrate of soda<br>Acid phosphate<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 1,780 | 250<br>400<br>160 | | 1,780 |
| Total and averages | 15 | | | | 16.14 | 983 |

### ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Cotton-seed meal<br>Nitrate of soda<br>Acid phosphate | 4 | 4.0 : 0 | 780 to 1,520 | 168<br>84<br>343 | 6.60 | 1,170 |
| Cotton-seed meal<br>Dried blood<br>Acid phosphate | 4 | 4.0 : 0 | 624 to 1,848 | 220<br>110<br>452 | 8.13 | 1,272 |
| Cotton-seed meal<br>Nitrate of soda<br>Acid phosphate<br>Kainit | 7 | 7.0 : 0 | 340 to 1,280 | 144<br>72<br>295<br>130 | 6.44 | 7.80 |
| Cotton-seed meal<br>Dried blood<br>Acid phosphate<br>Kainit | 10 | 9.0 : 1 | 360 to 1.614 | 154<br>77<br>416<br>178 | 7.44 | 895 |
| Total and averages | 25 | | | | 7.14 | 967 |

## ONIONS.

There have been recorded the results of 114 tests of substances applied to soils for onions, 69 in Massachusetts, 43 in Ohio, and 2 in Kansas, as follows:

*Results of fertilizer tests on soils for onions.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 6 | 6.0 : 0 | 612 to 7,717 | 380 | 9.50 | 2,267 |
| Acid phosphate | 5 | 1.5 : 1 | − 930 to 560 | 656 | 4.59 | − 157 |
| Muriate of potash | 4 | 1.0 : 1 | − 588 to 1,680 | 320 | 7.04 | 298 |
| Rock phosphate | 3 | 2.0 : 1 | −1,586 to 2,823 | 377 | 1.70 | 842 |
| Basic slag | 1 | 1.0 : 0 | 3,676 | 538 | 3.36 | 3,676 |
| Apatite | 1 | 1.0 : 0 | 2,142 | 256 | ........ | 2,142 |
| Gypsum | 1 | 0.0 : 1 | − 1,589 | 400 | 1.60 | −1,589 |
| Salt | 6 | 3.0 : 1 | −7,063 to 5,750 | 1,000 | 4.00 | 478 |
| Wood ashes | 8 | 1.0 : 7 | −3,500 to 2,500 | 2,062 | 5.16 | −2,602 |
| Total and averages | 35 | 1.3 : 1 | .................. | ........ | 5.39 | 24 |
| MIXTURES OF TWO MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate | 4 | 4.0 : 0 | 7,249 to 13,552 | 320<br>640 | 12.48 | 9,048 |
| Nitrate of soda<br>Muriate of potash | 4 | 0.3 : 1 | −2,418 to 1,080 | 320<br>320 | 15.04 | − 655 |
| Nitrate of soda<br>Lime | 5 | 5.0 : 0 | 1,550 to 12,025 | 320<br>1,680 | 13.04 | 4,946 |
| Acid phosphate<br>Muriate of potash | 4 | 4.0 : 0 | 1,907 to 8,680 | 640<br>320 | 11.52 | 6,072 |
| Acid phosphate<br>Lime | 4 | 0.0 : 4 | −3,030 to − 50 | 640<br>1,600 | 9.28 | 1,559 |
| Muriate of potash<br>Lime | 4 | 4.0 : 0 | 7,398 to 19,385 | 320<br>1,600 | 11.84 | 12,571 |
| Lime<br>Gypsum | 1 | 0.0 : 1 | − 3,789 | 400<br>400 | 2.80 | − 3,789 |
| Total and averages | 26 | ........ | .................. | ........ | 11.87 | 4,927 |
| MIXTURES OF THREE MINERALS. | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 4 | 4.0 : 0 | 2,207 to 17,280 | 320<br>640<br>320 | 19.52 | 8,672 |
| Nitrate of soda<br>Acid phosphate<br>Lime | 3 | 3.0 : 0 | 5,350 to 9,387 | 320<br>640<br>1,467 | 16.88 | 6,756 |
| Nitrate of soda<br>Muriate of potash<br>Lime | 4 | 4.0 : 0 | 6,548 to 19,675 | 320<br>320<br>1,600 | 19.84 | 12,136 |
| Acid phosphate<br>Muriate of potash<br>Lime | 4 | 4.0 : 0 | 8,549 to 14,770 | 640<br>320<br>1,600 | 16.32 | 11,881 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash<br>Lime | 4 | 4.0 : 0 | 10,466 to 20,410 | 320<br>640<br>320<br>1,600 | 24.32 | 16,050 |
| Total and averages | 19 | ........ | .................. | ........ | 19.51 | 11,328 |

*Results of fertilizer tests on soils for onions*—Continued.

ORGANIC FERTILIZERS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. |  | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
|  |  | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Ground bone | 3 | 3.0 : 0 | 348 to 3,602 | 437 | 5.69 | 1,873 |
| Boneblack | 1 | 1.0 : 0 | 1,477 | 560 | 6.16 | 1,477 |
| Total and averages | 4 | .......... | .......... | .......... | 5.81 | 1,777 |

MANURE AND COMBINATIONS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Manure | 6 | 5.0 : 1 | −2,500 to 9,500 | 11,667 | 2.92 | 2,302 |
| Hen manure | 8 | 3.0 : 1 | −2,500 to 2,500 | [a] 88 | .......... | 834 |
| Total and averages | 14 | .......... | .......... | .......... | 2.92 | 2,302 |

COMMERCIAL FERTILIZERS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Commercial fertilizers | 16 | 15.0 : 1 | −2,000 to 9,500 | 1,250 | 12.50 | 2,825 |

[a] Bushels.

## CUCUMBERS.

There have been recorded the results of 18 tests of substances applied to soils in North Carolina for cucumbers, with the following results:

*Results of fertilizer tests on soils for cucumbers.*

MIXTURES OF TWO MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. |  | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
|  |  | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda<br>Acid phosphate | 1 | 1.0 : 0 | 7,931 | 250<br>400 | 9.05 | 7,931 |
| Nitrate of soda<br>Muriate of potash | 1 | 0.0 : 1 | − 319 | 250<br>160 | 9.77 | − 319 |
| Acid phosphate<br>Muriate of potash | 1 | 1.0 : 0 | 1,079 | 400<br>160 | 6.32 | 1,079 |
| Total and averages | 3 | .......... | .......... | .......... | 8.38 | 2,897 |

MIXTURES OF THREE MINERALS.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Used. | Cost. | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash | 1 | 1.0 : 0 | 8,921 | 250<br>400<br>160 | 13.85 | 8,921 |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 11 | 11.0 : 0 | 123 to 9,683 | 341<br>545<br>207 | 16.90 | 4,826 |
| Nitrate of soda<br>Acid phosphate<br>Kainit | 1 | 1.0 : 0 | 855 | 250<br>400<br>160 | 10.01 | 855 |
| Nitrate of soda<br>Acid phosphate<br>Carbonate of potash and magnesia | 1 | 1.0 : 0 | 2,921 | 250<br>400<br>160 | .......... | 2,921 |
| Nitrate of soda<br>Acid phosphate<br>Sulphate of potash and magnesia | 1 | 1.0 : 0 | 2,737 | 250<br>400<br>160 | .......... | 2,737 |
| Total and averages | 15 | .......... | .......... | .......... | 16.14 | 4,835 |

## MUSKMELONS.

There have been recorded the results of 18 tests of substances applied to soils in New Jersey for muskmelons, which are contained in the following table:

*Results of fertilizer tests on soils for muskmelons.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. |  | Average crop increase per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
|  |  | *Ratio.* | *Pounds.* | *Pounds.* | *Dollars.* | *Pounds.* |
| Nitrate of soda | 6 | 6.0 : 0 | 890 to 22,980 | 267 | 6.67 | 11,042 |
| Sulphate of ammonia | 6 | 2.0 : 1 | −4,490 to 19,740 | 213 | 6.61 | 5,587 |
| Total and averages | 12 |  |  |  | 6.64 | 8,314 |

ORGANIC FERTILIZERS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Used. | Cost. | Average crop increase per acre. |
|---|---|---|---|---|---|---|
| Dried blood | 6 | 6.0 : 0 | 290 to 18,210 | 355 | 7.10 | 8,193 |

## CELERY.

There have been recorded the results of 4 tests made on soils in New Jersey for celery as follows:

*Results of fertilizer tests on soils for celery.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yield. | Fertilizer per acre. |  | Crop increase per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
| Nitrate of soda | 4 | *Ratio.*<br>4.0 : 0 | *Pounds.*<br>6,600 to 18,900 | *Pounds.*<br>350 | *Dollars.*<br>8.75 | *Pounds.*<br>13,875 |

## CARROTS.

There have been recorded the results of 4 tests made on soils in New Jersey for carrots as follows:

*Results of fertilizer tests on soils for carrots.*

MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. |  | Crop decrease per acre. |
|---|---|---|---|---|---|---|
|  |  |  |  | Used. | Cost. |  |
| Nitrate of soda | 4 | *Ratio.*<br>0.0 : 4 | *Pounds.*<br>−6,760 to −1,520 | *Pounds.*<br>350 | *Dollars.*<br>8.75 | *Pounds.*<br>−4,542 |

## PEACHES.

There have been recorded the results of 72 tests of substances applied to soils in New Jersey for peaches as shown in the following table:

*Results of fertilizer tests on soils for peaches.*

### MINERALS SINGLY.

| Kind of fertilizer used. | Number of experiments. | Increase to no increase. | Range of effects as shown in yields. | Fertilizer per acre. | | Average crop increase or decrease per acre. |
|---|---|---|---|---|---|---|
| | | | | Used. | Cost. | |
| | | *Ratio.* | *Baskets.* | *Pounds.* | *Dollars.* | *Baskets.* |
| Nitrate of soda | 6 | 0.0 : 6 | −90 to −28 | 150 | 3.75 | −54 |
| Acid phosphate | 7 | 2.5 : 1 | −33 to 52 | 350 | 2.45 | −17 |
| Muriate of potash | 7 | 7.0 : 1 | 10 to 176 | 150 | 3.30 | 67 |
| Gypsum | 7 | 7.0 : 0 | 18 to 128 | 400 | 1.60 | 67 |
| Total and averages | 27 | | | | 2.70 | 51 |
| **MIXTURES OF TWO MINERALS.** | | | | | | |
| Nitrate of soda<br>Acid phosphate | 7 | 7.0 : 0 | 27 to 147 | 150<br>350 | 6.20 | 88 |
| Nitrate of soda<br>Muriate of potash | 7 | 2.5 : 1 | −13 to 169 | 150<br>150 | 7.05 | 68 |
| Acid phosphate<br>Muriate of potash | 7 | 7.0 : 0 | 60 to 221 | 350<br>150 | 5.75 | 115 |
| Total and averages | 21 | | | | 6.33 | 90 |
| **MIXTURES OF THREE MINERALS.** | | | | | | |
| Nitrate of soda<br>Acid phosphate<br>Muriate of potash | 7 | 6.0 : 1 | − 3 to 270 | 150<br>350<br>150 | 9.50 | 136 |
| Nitrate of soda<br>Boneblack<br>Muriate of potash | 2 | 2.0 : 0 | 1 to 31 | 480<br>600<br>400 | 27.40 | 16 |
| Total and averages | 9 | | | | 13.48 | 109 |
| **ORGANIC FERTILIZERS WITH ONE MINERAL.** | | | | | | |
| Ground bone<br>Muriate of potash | 1 | 1.0 : 0 | 49 | 400<br>160 | 8.72 | 49 |
| **MANURE AND COMBINATIONS.** | | | | | | |
| Manure | 7 | 7.0 : 0 | 9 to 291 | 40,000 | 10.00 | 152 |
| Manure<br>Lime | 7 | 2.5 : 1 | −51 to 91 | 20,000<br>2,250 | 12.50 | 34 |
| Total and averages | 14 | | | | 11.25 | 93 |

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